THE

ELECTRICAL REVIEW.

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ELECTRICAL REVIEW.

Vol. LVII.] CONTENTS: November 10, 1905. [No. 1,459.

	Page
The British Science Guild	745
Surface Contact Systems (*illus.*)	748
Lead-Covered Wiring	750
Colliery and Mining Switchgear for High and Low Tension Alternating Current Service (*illus.*) (*continued*)	751
The Olympia Electrical Exhibition (*illus.*) (*continued*) ...	753
Gerard & Fiedler Storage Cell (*illus.*)	755
Correspondence	755
Business Notes	758
Electricity in the London Hospital (*illus.*)	765
Electricity Supply Accounts	772
City Notes	773
Electric Tramway and Railway Traffic Returns	776
Stocks and Shares	776
Share List of Electrical Companies	777
Proceedings of Institutions:—	
Is Machine Stoking Economical (*concluded*)	779
The Problem of the Gas Turbine	780
Legal	781
New Electrical Devices, Fittings and Plant (*illus.*) (*continued*)	784
Electric Lighting Companies and Compulsory Purchase (*concluded*)	786
Our Legal Query Column	787
New Patents Applied For	787
Published Specifications	788

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THE BRITISH SCIENCE GUILD.

On p. 714 of our last issue we gave a brief report of the meeting held at the Mansion House on October 30th, when the British Science Guild was inaugurated. The meeting was attended by several ladies, and by many men of title or degree, most of whom are well known in the social and political world. The speeches made on that occasion, and the objects which the promoters of the Guild have set before them, have been reported in the Press, where they have doubtless been studied by our readers. As published in their circular, the objects of the Guild are ambitious and heterogeneous, for they include teaching the people at large "the necessity of applying the methods of science to all branches of human endeavour"; bringing before the Government the scientific aspect of all matters affecting the national welfare; promoting the application of science to industry; and encouraging scientific education by the support of universities and kindred institutions. The speeches delivered at the meeting were also heterogeneous, some men enlarging upon one "object," others upon another; until we feel some uncertainty as to whether the promoters of the Guild are really "pulling together," and as to the particular object upon which the new society, if successfully launched, will concentrate its endeavours.

In comparison with the aim of the Guild which we have reproduced within quotation marks, the last two objects set forth are of greatly inferior importance. Within the United Kingdom, a very respectable proportion of the more modern manufacturers who work on a sufficiently large scale have already so deep an appreciation of the value of science that they regularly employ a staff of experts, providing fairly well equipped laboratories for testing and researches. Those of our scientific training establishments that turn out thoroughly grounded and educated students find comparatively little difficulty in placing their passed pupils, and none at all in obtaining youths to teach. Salaries paid still tend to be low, or rather incommensurate with the expense of the training; but this is largely due to the fact that the expense has only quite recently reached its present figure. In a few years' time this defect will probably vanish. Many of our training institutions are so poorly off that the professors receive inadequate salaries, or the Chairs attract only men of inferior abilities. This needs alteration, but a British Science Guild is a massive instrument to wield for the purpose.

The second object, that of approaching the Government, is already undertaken by existing learned societies, or would be so, if it were more often possible to achieve any useful results. In present conditions, it is difficult to understand how any man of science, or committee, can take the trouble of attempting to advise the Government, knowing full well that the energy expended will only be dissipated in the production of a Blue Book. Moreover, we have among us,

for at least one week every year, a British Association for the Advancement of Science, which is supposed to undertake all these things; although, perhaps, its sphere of actual utility is limited to the provision of an opportunity between June and November for claiming priority of publication.

Hence it follows, that if the new Guild is to justify its creation and existence, it should devote the whole of its time and money to the education of the people in the application of scientific methods to the processes of daily life; and we may say at once that if it achieve any measure of success in that direction, it will not have been formed in vain. The application of precise and organised knowledge to common things is so conspicuous by its absence—in spite of the *Times*' assertion that the door is open—that difficulty arises in picking out instances to quote. Our fellow countrymen buy bread and coal, the two prime requisites of life, under conditions in which the mass of nutriment or combustible obtained per unit of money is largely unknown; the bread is unweighed, the ash in the coal not determined. We have countless men of science among us, but our arrangements are such that they can usually enter a body of local or Imperial Government only with great loss of their self-respect. A few constituencies have at one time or another been content to send a certain man to the House of Commons because of his scientific ability as "Speaker," thus sacrificing their vote altogether for the general good. But no constituency ever sends a man of science to the House in that capacity alone, where he might prove of great value to the country. A man of science, natural science or law, must be willing to play the party game first, sinking his convictions before the instructions of the Whips (when they clash) if he is to be an "M.P." And the British Science Guild hopes largely to recruit its members from the central and district governing bodies—also from representatives of labour.

It is no part of our duty to say how the thing should be done, but simply to point out what, in our opinion, the country requires in the so-called scientific direction. The crying need of the present day is the introduction of the scientific spirit into everyday life; the application of common-sense and codified knowledge to every operation of the home, the kitchen, the nursery, the sick room, to all processes of business, to social and political affairs, and to the conduct of the newspaper and magazine press. If the British Science Guild can teach the public that there is a right and a wrong way of performing every single duty of our daily life, can explain the reason for the right way and the reasons against the wrong way, can induce the public to prefer and adopt the right way when shown it, and can further persuade the public to think logically and argue out the better course for themselves in novel situations instead of blindly following tradition or prejudice; if, indeed, the Association can make the public realise that there are two sides to every question, and that consideration will generally urge the adoption of one to the exclusion of the other—if the British Science Guild can do this, it will become one of the most potent factors for good in existence, and will receive from men of science the recognition and assistance it asks. That should be the primary aim of the Guild—the inoculation of the public with a love of precision in domestic and hygienic affairs; and if the members seek this object first, all the others—the conversion of the central and local governments, and of conservative manufacturers, a better financial position among the training colleges, an insistance upon accuracy and instruction in general literature on the part of the reader, more successful times for many branches of industry, and an all-round improvement of the race in physique and intellect—shall be added unto it.

Electrical Steel in Canada.

Dr. Heroult, the inventor of the process used in Europe for the manufacture of aluminium, and one of the pioneers of electrical methods for preparing iron and steel, is now in America, dividing his attention between the Syracuse factory of the Holcomb Steel Co. and the Canadian experiments which are shortly to be carried out at Sault Ste. Marie. In the former place a plant costing one million dollars has been laid down, equal to the production of 80 or 100 tons of pig-iron daily, while it is also intended to make tool steel and high class billets there by the Héroult electrical process. In Canada Dr. Héroult will be associated with Dr. Haanel, superintendent of mines, and author of the Government report upon the electrical treatment of iron ores, of which we have already given an account. Pig-iron and steel are to be made at Sault Ste. Marie in a plant of special design, with the aid of which Dr. Héroult believes that pig-iron can be produced at $10 and steel at about $14 per ton. According to the Canadian *Manufacturer*, Dr. Héroult has prophesied that in ten years' time Canada will be the most important producer of both wheat and iron in the world. He holds that the Dominion possesses three times as much ore as Sweden, which can now be worked up profitably.

Infringement of Patent.

A case which illustrates with some force the necessity of a patentee in an action for infringement being able to prove his case up to the hilt has recently been decided in the Scots Court of Session. We refer to the case of the Mica Insulator Co., Ltd., *v.* Bruce Peebles & Co., Ltd. According to the judgement delivered by the Lord President of the First Division on July 6th, 1905, the plaintiffs claimed damages for breach of a contract whereby the defendants were alleged to have agreed not to buy certain mica cloth elsewhere than from the plaintiffs. It was also alleged that the defendants had infringed the plaintiffs' patents by themselves selling and using mica cloth which they had manufactured in breach of the plaintiffs' patents. As to the alleged breach of contract, there does not appear to have been a dispute, but the defendants alleged with reference to the question of infringement, that the particulars of claim were insufficient. The patents alleged to have been infringed were a patent dated 1892, and amended on August 2nd, 1904, and a patent dated 1895, and amended on August 27th, 1904. The plaintiffs said that they believed and averred that the defendants have been manufacturing and continue to manufacture extra flexible micanite cloth. In manufacturing the said micanite and extra flexible micanite cloth as aforesaid, the pursuers have used and employed the inventions protected by the said letters patent, or one or other of them, and described in the amended specifications relative thereto, and have infringed the said letters patent or one or other of them. The plaintiffs further believe and aver that since the beginning of 1902 the defenders have been purchasing from other persons micanite and extra flexible micanite cloth made in contravention and infringement of the said letters patent, or one or other of them, and have thereby infringed the same. In particular, they believe and aver that at various dates during the said period the defenders have bought from one Brandt, in Hamburg, and used in their machines in Scotland, micanite made in contravention of the said letters patent, and have purchased from the Bergmann Electricitäts-Gesellschaft, of Berlin, machines insulated in infringement of the said letters patent, and sold them to various persons in England and Scotland.

The Court held that these particulars were insufficient, and the plaintiffs were mulcted in costs. Patentees who imagine that their rights are being infringed should bear the principle of this case in mind. It is of importance that when a patentee accuses any person of infringement, particulars of dates and places, and particulars showing in what way the alleged infringement does entrench upon the plaintiffs' rights should be forthcoming. The law of Scotland resembles in this respect the law of England, with the difference that in Scotland the claim and full particulars

must be embodied in one document, whereas in England "particulars" are delivered in a document separate from the statement of claim. No proofs of any infringement is allowed, except that mentioned in the particulars. "The object of having these particulars," said Wood, V.C., in an old case, "is to give the defendant fair notice of what the complaint against him is, not to tie the plaintiffs down to the precise terms of any verbal definition, or to make the trial of the issue turn upon the point of form. Full and fair notice the defendant is entitled to." It is not necessary, however, for the plaintiffs to set out every breach specifically. Thus, where the plaintiff complained generally of the defendant making and selling pictures made by a special process, and added, "One of such pictures was made and sold by the defendant to one C. on the 27th April, 1854; but plaintiff states this by way of example only, and not so as to preclude him at the trial from insisting on other infringements," the Court refused to order further particulars, apparently on the ground that the instance given being representative of all the others, there was no likelihood of surprise.

Holophane Globes and Dust.

It has long been an article of faith amongst electricians that dust, if allowed to accumulate on lamp globes, absorbs a very large amount of light. From experiments carried out at the Electrical Testing Laboratories of New York, and reported in the *Electrical World and Engineer*, of October 7th, it would appear that in the case of holophane globes at any rate, dust is of little importance if confined to the outside of the globes only. Holophane globes are designed to give an increased illumination downwards, and since dust settles mostly on the upper surfaces of the prisms, which are intended to be totally reflecting and not transmitting surfaces, it follows that there is little loss of light except in an upward direction, in which direction the illumination is low in any case.

The experiment was carried out as follows:—A holophane globe with its opening covered was suspended for several months in the position in which it would be ordinarily used. A 32-C.P. lamp was then inserted into the globe, and a series of candle-power measurements was made. The globe was then cleaned and a second series of measurements was made at all the usual angles. The loss of light found was as follows:—

60° above horizontal	19 per cent.
30° "	30 "
Horizontally	17 "
30° below horizontal	2 "
60° "	*nil.*

It will thus be seen that there is surprisingly little loss of light in the lower hemisphere, where the illumination is greatest and is generally of the greatest importance.

The Effect of Mechanical Boiler Cleaners on Tubes.

From tests made in America by Mr. W. A. Parsons, it would appear that mechanical tube cleaners of the percussion type may be a cause of tube distortion. He experimented with three different instruments, two of which required 15 lb. pressure of steam or air to work them, while the third required 80 lb. to do work at the same rate. The results showed that the instrument with the longest stroke had most effect in distorting the tube, and also that cushioning of the blow was beneficial. The most satisfactory cleaner gave the greatest number of blows per minute, or over 11,000 as compared with the 3,600 odd blows of the longest stroke instrument. The conclusions drawn are that cushioning is desirable, and that it is better to employ an instrument which requires a high working pressure, because if a low pressure instrument is carelessly worked with high pressure steam, the mischief it may do will be intensified to a greater degree than can be the case with an instrument requiring high pressure for ordinary work. Care ought to be taken not to let a tube cleaner remain in one place while at work. It should be kept constantly in movement to and fro in the tube. The tube cleaners referred to appear to be for fire-tube work rather than water-tubes, for the paper contains a discussion of the effect upon the collapsing strength of the tube of such distortion of a thin tube as may be produced by careless handling of a cleaner.

"The New Electricity."

When editors of non-technical newspapers wish to instruct their readers in the wonders of science, why do they not employ a competent scientific expert? An article on "The New Electricity" in a recent number of *T. P.'s Weekly* suggests this question. Few of our readers would guess that the "New Electricity" is the ordinary alternating current. Why should the epithet *new* be applied to a variety of the electric current which, as produced by induction, was discovered by Faraday more than half a century ago, and, as produced by the discharge of the Leyden jar, preceded the discovery of the galvanic battery? Tesla's investigations on high frequency currents, which are described by the writer with lamentable inaccuracy, are of more modern date, and might have some claim to novelty in a popular newspaper, though Tesla's discoveries were not made yesterday. Referring to the high frequency current, the writer says:—"Anyone can take in one hand the terminal of an apparatus throwing off a high frequency current of several million volts (*sic*), and, by the mere contact of the other hand, cause an electric lamp to light, without being aware of *the enormous energy passing through the body.*" Deceived by the "several million volts," the writer evidently thinks there must be an enormous amount of energy present. A spark obtained by rubbing a sheet of brown paper may have a voltage of several millions, and yet no one would think of asserting that it contained "an enormous energy." The energy required to light a Tesla lamp is very small, as the current is confined to a thin layer of the surface, and even so does not give sufficient illumination to be of any practical use. Another gem from this popular essay on the "New Electricity" is the following: "The difficulty of conducting a continuous current of more than (say) 5,000 volts for any really long distance is practically insuperable, while, with the alternating current, the difficulty is rather to prevent the current passing than how to hinder its escape." Many an electrical engineer would be very pleased to find an alternating current that would refuse to leak and required to be held back to prevent it from rushing in too great strength along the conductor. The dynamo is simply described by *T. P.'s* physicist as a coil of copper wire rotated about the poles of a permanent magnet, and it is stated that a great step in advance was made when it was shown to be possible to get rid of the magnet altogether! It would almost appear that *T. P.'s Weekly* had employed to write this article a schoolboy who had read a popular magazine article on Tesla currents, which he had failed to understand.

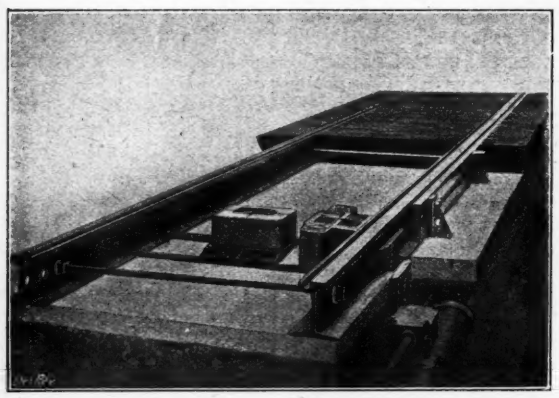
London's Electricity Supply.

Last week we commented upon the prospect of a three-cornered contest for the privilege of supplying London with electricity in bulk. Our estimates were, however, 40 per cent. short of the mark, for it appears that there will be two other combatants to reckon with. One will be a "combine" of existing supply companies; the other, if the daily Press is rightly informed, is an entirely new and hitherto unsuspected competitor—a company, backed by some of the great railway companies, which proposes to establish a large generating station at St. Neots, and to transmit power by means of mains laid along the Great Northern Railway to a transforming station at Enfield, whence it will be distributed *viâ* the railways and canals to all parts of London, to bulk consumers only. The pressure named is 15,000 volts, but as the distance from St. Neots to London is over 50 miles, it is hardly necessary to point out that such a pressure would put the scheme out of court at once. The company is said to talk about energy at ½d. a unit in London. At least three times, and preferably four times, the stated pressure would have to be adopted, of course using overhead mains. Coal can be got to St. Neots only by rail, and it would undoubtedly be cheaper to bring to within 10 miles of London than to transmit electrical energy from St. Neots. The scheme seems absurd; but perhaps the particulars are incorrect.

SURFACE CONTACT SYSTEMS.

There are now four systems in England which are alive (*absit omen*) or in a state of partially suspended animation. They are :—

1. The "Lorain," which has been at work in Wolverhampton on 11 miles of track for some years.
2. The "Dolter," which has been at work in Paris and Dresden on experimental lines, and is in course of construction in Torquay.
3. The "G.B." system, which has not been in operation outside an experimental track a few hundred yards long, but is being installed in Lincoln.
4. The "Kingsland," which has been subjected to the same kind of trials as the "Dolter" at Dresden, and has been in use on a short private track for several years.



Kingsland System: Track in Course of Construction.

The "Lorain" we all know. It is an electro-magnetic system, with switches placed at even distances along the centre of the track, except at curves, points and crossings, when they are placed more closely to each other, and more or less remotely from the centre line, according to circumstances.

In order to energise the switches, which are of the perpendicular gravity type, heavy magnets are carried on the collecting skate, and the energy required by these magnets amounts to about 20 per cent. of the useful energy employed in moving the car. A battery of accumulators is carried on each car to pick up the switches when for some reason the skate magnets have been open-circuited.

The studs form rather objectionable obstacles for wheeled traffic, but drivers and cyclists soon learn to avoid them. The switches appear to give little or no trouble now on account of sticking or failure of insulation ; but this is due largely to the extreme care and frequency with which they are tested.

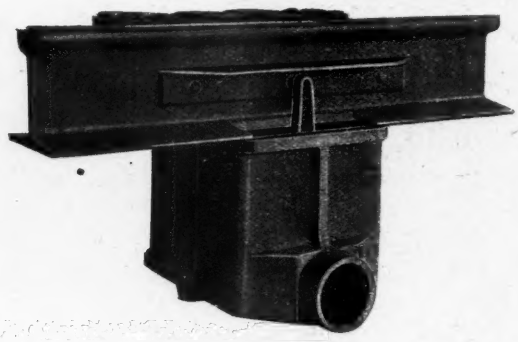
The wear on the skates and the studs is said to be a serious item in the cost of maintenance. It seems probable that the cost of maintenance will increase with age at a higher ratio than in the case of the overhead system, as so much more depends on the smooth motion of the cars, and for that reason the track—foundation, rails, paving and contact boxes—must be maintained in better condition than is usual.

While many surface-contact systems have been tried on the Continent, and especially in Paris, we do not remember to have heard a good report of any of them up to a year ago at least, so that the Lorain system has much of which to be proud.

No one now can condemn it as impracticable, or on the ground of unreliability, but a very strong case can be brought against it on the score of economy, for it is much more costly than the overhead system (as we have shown many times) both to construct and to maintain, while the general life of the system is an unknown quantity.

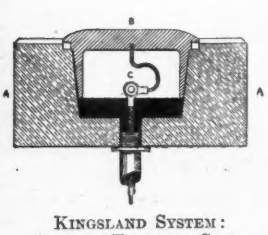
The Dolter system was described in the Electrical Review of September 19th, 1902. It has a strong likeness to the Lorain system, but gives the impression of being sounder in detail. Certainly we should say that the Dolter will work wherever the Lorain works, and give more satisfaction.

It is afflicted with the heavy magnetising skates common to its type, and it will suffer in at least as great a degree as the Lorain from the wear and tear of this part, while the magnetising losses will not be much, if any, less ; and it seems probable that the faults which threaten the switchgear of one must be expected in the other. All electro-magnetic systems are equally liable to trouble from the collection of pieces of metal under the skate, and from the proximity of studs to rails at special work, so the Dolter is not better than any other on these points.

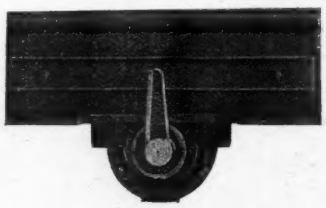


Complete Switch-Box, Striking Lever and Rail.

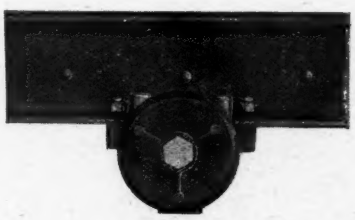
In fact, the Dolter and the Lorain systems stand or fall together, for their differences are not important enough to raise either above criticism on the main features of construction and operation.



Kingsland System: Section Through Stud.



Rail, Switch-Lever and Guard, and Contact Box.



Back of Contact Box.

Next we come to the "G.B." system, which differs substantially from every other electro-magnetic system in that direct contact is made between the switch and the cable. It was fully described in our issue of Jan. 15th, 1904.

A bare cable of iron wire is carried on insulators through a continuous vitrified earthenware pipe. At intervals of about 10 ft. occur earthenware tees which contain the switches. Upon the car is the usual collection of magnets, but the collecting and magnetising skate is formed by a specially constructed chain. It is the flexibility of this skate which permits the stud to be kept flush with the road.

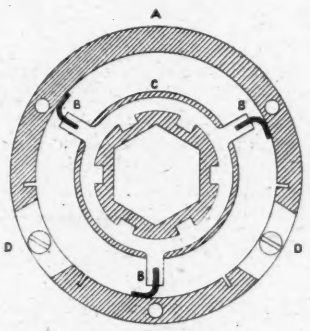
Unlike all the other well-known systems, the "G.B." magnetic circuit is completed through comparatively great distances in air ; obviously, therefore, equal efforts can be obtained only by the expenditure of a greater amount of power in the "G.B." magnets.

While the advantage of a flush stud is undeniable, it may be bought too dearly, and the very flexibility of the chain

will introduce contact resistances which may become serious in the course of time.

The enormous number of joints and air-gaps in the magnetic circuit and of joints and contacts in the electric circuit bid fair to ruin this system, even if they were the only faults; but it is only too probable that damp will play havoc with the insulation of the conduit, that the contact between the carbon block and the circular stranded cable will deteriorate rapidly under the conditions which have to be faced outside an experimental track, and that the cost of construction and maintenance will be no less than for the systems named above. The Dolter switch looks more trustworthy than the "G.B.," while the superiority of its contact is obvious.

In short, it is difficult to discover any advantage which can be set to the credit of the "G.B." system against any other, with the exceptions of the flush stud,



Kingsland System: Vertical Section through Contact Box.

and the remarkably low cost of construction—a feature which cannot be ignored in discussing this subject.

Finally, there is the "Kingsland" system, which has been seeking public favour in England, and finding none, for a longer period than any of the foregoing. It has a resemblance to the "G.B.," Schuckert and Claret-Veuilleumier systems, in so far as the stud is just a solid block of iron let into granite, and the cable is attached directly to it, but there its resemblance to those systems, or to any other, ceases, for the switch which makes the cable and stud alive at the proper moment only is made to do so by positive mechanical means. This simplifies the problem immensely, for, in the first place, the skate is reduced from a cumbersome and energy-eating collection of electro-magnets, which weigh as much as a ton, to a light strip of iron or steel costing a few pence. That makes an immediate economy of ¼d. to ½d. per car-mile according to the price of energy, and that is no mean item now that things are cut so fine.

The switch is more complex than other switches, but its complexity cannot be said to detract from its reliability. Every part is designed with a high factor of safety, and the actual movements are very simple. The old star-wheel has been replaced by a single lever, which moves the switch one-sixth of a revolution in the same direction, no matter which way the lever itself is moved.

Probably the switch box is no more and no less watertight than the switch box of any surface-contact system. Every inventor says that his own system is perfect in this respect, and we believe this to be approximately true; but while the presence of moisture in the switch box of a magnetic system is a source of grave inconvenience, the Kingsland switch is not affected in the same degree.

The strikers, which are fixed fore and aft of the truck at points of least motion, travel in a channel formed by a guard rail of the same height as the running rail and attached firmly thereto. That channel seems to be the objection to which the system is still subject, although it is difficult to see how much worse it is than the channel of the conduit system. Doubtless, it is more objectionable than a track with no channel at all, and it must be remembered always that we hold the overhead system to be the best of all; but it does seem to be a small thing compared to the stumbling-blocks presented by the best of the electro-magnetic systems.

The trouble with the channel, and the only trouble, is its liability to become choked. It is no excuse to say that conduit systems run the same risk. They do run it, and they have to pay for it by way of cleaning; but there is a wide difference between the conduit, with the long, slender plough containing cables and contact shoes dipping into a carefully-prepared tunnel having conductor rails on each side supported on insulators, and the short stout striker of the Kingsland system ploughing its way, if necessary, through the accumulated dirt of weeks with little more need for force than an efficient rail-cleaner.

"If necessary" we said, but it ought not to be necessary. Nothing larger than a pebble can find its way into the slot, and the mud which would fill the channel in dirty weather could be dealt with by the lads who cleaned the points, as much of it as did not find its way to the surface drainage system to which the sump under every switch box is connected. As the switches are only 15 to 20 ft. apart, no one can deny that ample provision is made for the drainage of this small channel.

The only possible case in which a channel along each rail must be provided is when a complete loop is described, and that does not often occur in practice.

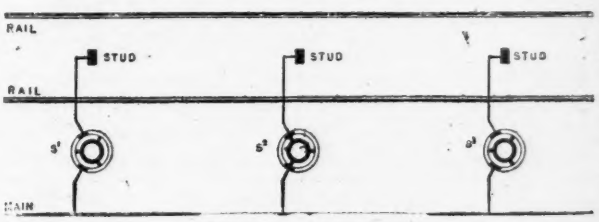
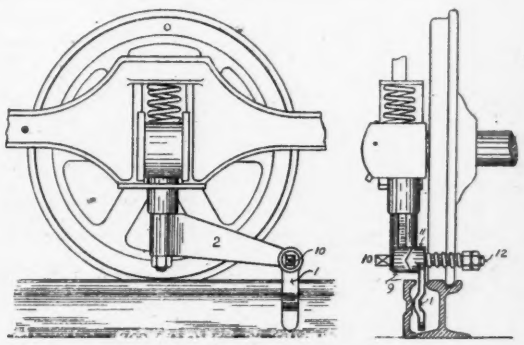


Diagram of Connections.

Candidly, we are inclined to brush aside this objection to the slot and channel, and if that can be done legitimately, the system emerges better in most points, and no worse in the rest, than the premier electro-magnetic system, whichever that may be.

The stud itself need not trouble us any more than the skate. Both are cheap and both easily replaceable. The cable connecting the stud to the switch is no more liable to fail than any house service. The switchbox is supposed to be watertight, and may be—it would be more than rash to say anything definite about this without the



Arrangement of Striking Gear.

experience of ten years at one's back—all we can say is that, in a day when motors are built, in the ordinary course of business, to work under water, there should be little difficulty in securing the permanent tightness of such a simple thing as the case of this switch.

The only things to fear then are the conduct of the switch proper under the severe conditions which may often occur, and the certainty of the trailing striker knocking the switch to the dead position.

The same fears confront us when we consider any kind of contact system, but we must confess to feeling greater certainty about the action of a mechanical positively-worked switch than about a magnetically-worked one, although we confess also that that mental attitude might be discounted largely in practice.

Every surface-contact system is designed so that contact is made at the leading stud before it is broken at the

trailing stud, and "sparking cannot occur." Nevertheless, it is wise to pretend that it can, and to provide for it accordingly.

No switch can be satisfactory which will not break successfully the heaviest current which experience leads us to expect. Ordinary working currents run up to 200 amperes on occasion (although it is probable that this would generally be divided between two studs), but short-circuit currents, running up to 500-1,000 amperes for a fraction of a second, must be dealt with likewise.

It is a drastic test, and we are not confident that any surface-contact system will pass it. If the Kingsland switch will do this, nothing more is wanted to prove the system superior to all but the overhead trolley wire with all its artistic and imaginary failings.

It is fairly evident from what has been said above that we look with favour, as we have since its inception, on the Kingsland system. We admit that our attitude must seem peculiar, as this system has not yet emerged from the probationary stage. Beyond being tried on a short length of public roadway in Dresden, we think we are right in saying that it has not been seen outside the private track at Wolverhampton, or at exhibitions. Our reasons for this favourable attitude have been stated briefly, and we have not attempted to demonstrate the peculiar advantages of all the component parts, preferring to leave that to the exploiters themselves, but we have felt that the one mechanical system was not being given a fair chance beside the many electro-magnetic systems, and we are anxious to direct renewed attention to it, believing that if the prejudice against the slot can be lived down, the simplicity and strength of the whole will win the day.

LEAD-COVERED WIRING.

By JOHN D. MACKENZIE.

The wiring problem—like the poor we have always with us, either in the description of a new system or the acclaiming or declaiming of an old one. But of all the various systems—and they are legion—lead-covered wiring is, perhaps, the one on which we have the greatest diversity of opinion, the advocates of the system being quite as dogmatic in their support of it as its opponents are in denouncing it. Yet really, when all is said and done, there is no system of electric wiring which can be regarded as a universal panacea for the ills that electric wiring is heir to, and so, finally, it comes to be a case of adjustment of pros and cons in order to decide which system is the best for each particular instance. If wiring contractors and consulting and municipal engineers could study each case absolutely on its merits, without any predisposition or bias, and recommend the system best suited to meet all the circumstances, the quality and durability of electrical installations, as a whole, would be instantly put on a higher level than it is at present.

In the following remarks I shall endeavour to place the advantages and disadvantages of lead-covered wiring side by side, and show how some of the disadvantages may be minimised:—

Advantages.—1. The wire comes to the contractor, already provided with its own continuous metallic sheathing, and generally requires no further protection.

2. The sheathing is watertight, and the whole installation can quite readily be made so too.

3. The great flexibility of the wire enables it to be installed with much less damage to buildings.

4. The small diameter of the wire enables it to be used in surface work, where any other system would be an eye-sore.

5. The difficulty of making joints practically compels the adoption of a loop-in system.

The disadvantages urged against the system are many and various, but fall under two general heads, viz.:—

1. Risk of injury during erection.

2. Risk of injury after erection.

To that, some add the risk of injury during manufacture. This, however, with the exception of one point, is no greater in lead-covered than in the ordinary taped and braided wiring. The one point of difference is in the heating to which the wires are subjected during the process of sheathing. Considering, however, the rapidity with which the wires are run through the lead press, and the tests which are afterwards applied to these cables, and which they successfully stand, the risk of damage seems very slight.

Before dealing more fully with the disadvantages attendant on the use of lead-covered wires, it may be as well to point out that, personally, I have no love for twin wires, either round or flat, considering it inadvisable, to say the least, to run the chance of an internal short-circuit inside a soft metal sheathing. It is far preferable to use single lead-covered wires, with the lead sheathing properly bonded and earthed, because it then requires two "earths"—one on each wire before one obtains a short-circuit, and on public supply systems an "earth" on the live wire means the blowing of a fuse. For these reasons, I do not intend to deal here with twin wires.

The risks of injury during erection, arise from (*a*) the carelessness of the wireman, and (*b*) from the carelessness of other workmen.

(*a*) The careless wireman cuts into the insulation when stripping off the lead sheathing; overheats and softens the insulation when sweating the sheathing into boxes for a water-tight system; overlooks the pin-holes caused by heated air bursting through the melted solder at such boxes; pulls the lead sheathing too hard, so making it brittle, and then it cracks when bent; hammers on his saddles too tight, and perhaps puts them on twisted, so cutting the lead by the edge of the saddle.

(*b*) The carelessness of other workmen is shown:—By the plasterer who cuts the lead with his trowel; the labourer who drops a shovel on it; the joiner who nails the flooring board to it; and by any man who walks with hobnailed boots over the top of it.

The risks after erection are:—

(*a*) The lead gives very little mechanical protection, from nails, for example.

(*b*) It may be successfully attacked by rats and mice.

(*c*) If a failure of insulation takes place, a wire cannot readily be withdrawn and replaced.

(*d*) Lead expands with increase of temperature, and may not go back to its original length when cold, and hence it may come in contact with other metals, or may even get cracked and broken.

(*e*) The electrical resistance of lead being high, contact with other metals may form a better "earth" than the proper earth connection.

(*f*) When an "earth" comes on, the lead may fuse at the point of contact as quickly as the fuse wire does.

(*g*) Pure water in the presence of air, and water containing salts in solution, such as ammonia, have a solvent action on lead.

(*h*) Decaying animal or vegetable matter under floors, &c., produce acetic acid, which, acting on the lead sheathing, has also a deleterious effect by forming "white lead."

(*i*) The presence of other metals, such as brass saddles in damp situations, causes electrolytic action.

(*j*) Where the lead sheathing is bared back to allow the wire to enter a switch or other fixture, there is a tendency for the current to creep on to the lead and escape at some other point, causing electrolytic corrosion.

The above list of defects, disadvantages, and possible risks of injury follows, with some variations, a very full arraignment of lead-covered wires, which appeared in these columns about a year ago under the name of Donald Smeaton Munro, and I take it to represent all, or nearly all, that can be said against the system.

The next point which arises is the question—"Is it possible to overcome or minimise the risks?"

Taking (*a*), viz., the careless wireman, it is quite possible to get *careful* workmen who will do *none* of these things; and, in any case, will a careless workman not cut into the insulation when removing the braiding from ordinary wire—will he not twist and kink the wire when drawing it into conduit, will he not leave ragged edges on his conduit so as to tear the insulation, will he not attempt to draw too many wires into a conduit, so straining the insulation and breaking the strands of wires; in short, what will the careless wireman *not* do? *Ergo*, get rid of him as quickly as you can.

(*b*) The risk of injury from other tradesmen is always present, and where lead-covered wiring has to be carried out while a building is in course of erection, special precautions must be taken to avoid injury—*e.g.*, laying temporary boarding over the runs of wire on the floors, lapping up with tape where coming out through plaster work, &c.

The faults after erection make the most formidable list, but it is quite possible to minimise these considerably.

(*a*) This point is made a good deal of by the opponents of lead-covered wiring, but seems to me to be grossly exaggerated. During the last seven years I have only had three instances in which lead wiring was damaged through nails or similar articles having been driven through the plaster work.

(*b*) This again is much exaggerated. Rats and mice have teeth which can easily work havoc on lead wire, but they seldom do so, and my own personal experience supplies no instance. These rodents will only attack lead wiring or lead water-pipes when in the direst straits for food or drink.

(*c*) This is the only point where conduit systems can show any real superiority over the lead-covered. The usual method of lead-covered wiring is to plaster it right in, and consequently it is impossible to withdraw it without damage to the plaster work. Several years ago the writer adopted the system of putting thin close-joint tubing in such walls as would be plastered up solid, dropping the lead-covered wires down this tube and drawing them taut, then placing an insulating bush top and bottom of tube, thus giving the advantage of a conduit system and also some more protection against an exploring nail.

(*d*) Here we have a fault not so much due to the lead-covered wire itself as to its indiscriminate use. Where wiring is to be subjected to *very* great variations in temperature, lead should not be used, but the writer has never found the ordinary temperature changes in house or shop to have any appreciable effect on the lead sheathing.

(*e*) In order to overcome this, all that is necessary is to bond all the lead wires together at frequent intervals, and so get the advantage of all the sheathing. For this purpose the writer uses a solder containing a large proportion of lead, and has found no trace of electrolytic action even in damp situations after years of use.

(*f*) The foregoing method of bonding the wires together tends to prevent the lead sheathing melting before the fuse does.

(*g* and *h*) The solvent effects of water with either air or salts in solution are certainly a possible disadvantage, but no more so than with thin enamelled conduits, which rust through in a very short time. Except under very exceptional circumstances, the amount of acetic acid which can be formed by decaying matter will not seriously harm the average lead-covered wire.

(*i*) Electrolytic action between brass saddles and the lead sheathing may quite easily be overcome by the use of lead saddles, which are quite as efficient.

(*j*) The current creeping along the insulation and on to the sheathing and causing electrolytic corrosion, is also easily overcome by dipping the ends of the wires up to the sheathing in melted joint-box compound. This also helps to increase the insulation resistance of the whole job.

The faults which so often occur on lead-covered wiring are all due to carelessness in the workmen, or because the conditions under which the wire is to work have not been properly appreciated. And the advantages to be obtained by the use of lead-covered wire make it easily worth the time spent in considering all the necessary circumstances. An example of what *not* to do was given a good many months ago in a letter published in these columns, where lead-covered wires had been drawn into iron gas pipes laid in the ground, with the inevitable result, viz., breakdown.

Here the lead covering was no doubt scratched, and perhaps cut while being drawn in, by the roughnesses inside the tube, and then it lay touching the iron and perhaps surrounded by moisture, either leaking in through pipe joints or due to condensation inside the tube, thus giving the very best chance for electrolytic action.

No one knowing the limitations of lead-covered wire would suggest or carry out such an arrangement, instead of which the wire ought to have been laid either in wood troughing and pitched in solid, or drawn into smooth earthenware or concrete conduits. It is the adoption of such obviously foolish arrangements as indicated which has given lead-covered wiring a name for want of reliability, and I trust the foregoing remarks may indicate, in some small measure, how to overcome some of the difficulties.

COLLIERY AND MINING SWITCHGEAR FOR HIGH AND LOW TENSION ALTERNATING-CURRENT SERVICE.

By A. M. RANDOLPH.

(*Continued from page* 726.)

Distribution Boards. — Underground (panel type).—Figs. 10 and 11 show respectively a front view and details of wiring in one of the compartments of a typical 3,000-volt three-phase sub-station distribution switchboard for underground service. In point of general design and in the details of construction this board is similar to the main generating station board already described and illustrated in figs. 1 to 4.

The particular point to be noted in connection with this type of board is the means that are provided for rendering it dustproof.

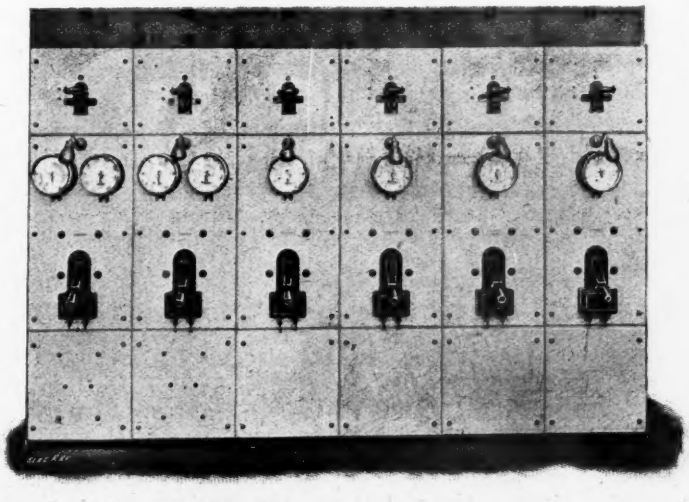


Fig. 10.—Three-Phase 3,000-Volt Underground Distribution Board; Front View.

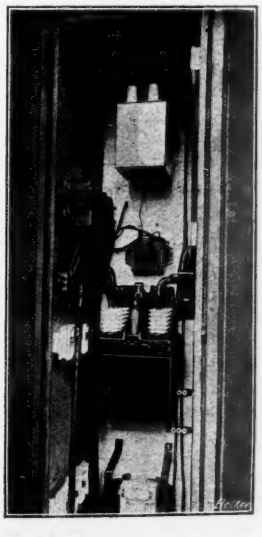


Fig. 11.—Back View. (One compartment opened to show details of wiring.)

With this end in view, the design of the isolating switches is changed from an open knife-blade type to an enclosed oil-immersed type. The operating handles of these switches are shown projecting through the top slabs of the panels. Further, the compartment doors at the rear of the panels are made of solid sheet metal, the same being interlocked, as in the case of the main board, with the isolating switches. Fig. 11 gives a fair idea of the arrangement of the panel connections, mounting of current transformers, &c.

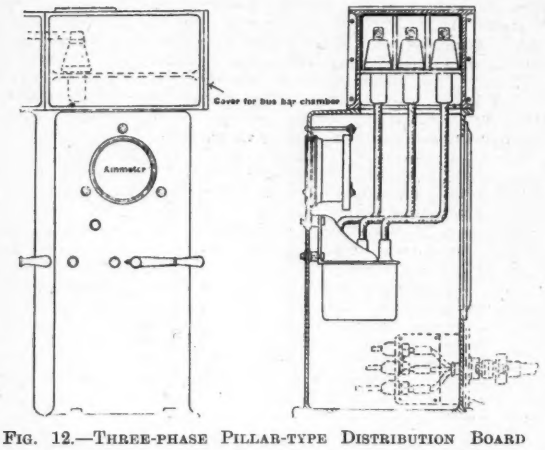


Fig. 12.—Three-phase Pillar-type Distribution Board for 3,000-volt Service. (Front and Sectional Elevations.)

Distribution Boards.—Underground (pillar type).—This type of switchboard has been developed to withstand rough usage and for installing in situations where the construction of specially protected switch rooms is not feasible. In these designs radical departures from standard types have been found advisable, and oil-break circuit-breakers have been adopted for opening all circuits, of whatever voltage, where the power to be dealt with exceeds certain limits.

In the case of circuits of small power, air-break switches and fuses are used. They are contained in gas-tight cases, and the fuses are of an enclosed type, such that on the blowing of the fuse the molten fuse metal is not in immediate contact with the air, and therefore cannot cause a sudden expansion of gas or give rise to danger inside the fuse chamber.

All underground boards are totally enclosed and of iron-clad construction, the apparatus, switchgear, multi-way junction boxes, &c., being enclosed in compact, self-contained, dust-proof, cast-iron chambers, designed so that an inspection of the interior may be readily made when desired.

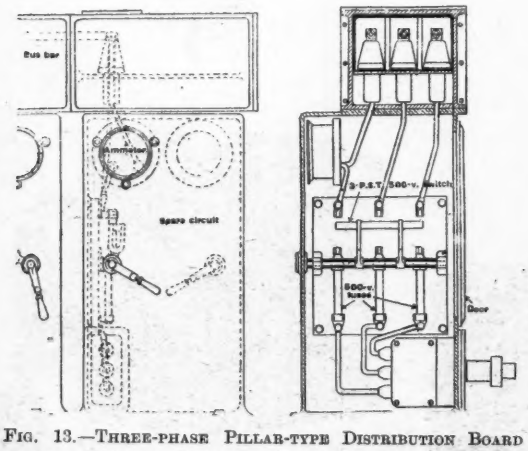


Fig. 13.—Three-phase Pillar-type Distribution Board for 600-volt Circuits. (Front and Sectional Elevations.)

The bus-bars are contained in a separate chamber, carried on and supported by the switch chambers mentioned above. The construction followed is on a unit system such that extensions may readily be made to an existing board, or any unit of an existing board may be removed if necessary, without interfering with the operation of the remaining portion of the board.

Interlocks may be conveniently fitted so that the doors of the chambers cannot be opened unless the main switch is in the "off" position; then, on the removal of plugs from the bus-bar chambers, all apparatus contained in any one unit is rendered "dead."

The space occupied by these boards is extremely small, this being advantageous to their adoption for underground work, large cuttings in the mine for the installation of bulky apparatus being avoided. The general construction of this system meets in a very satisfactory degree mining conditions as to portability, atmospheric and fire-damp risks, durability, convenience of operation and minimum risk of failure. Fig. 12 shows the front and sectional elevations of a typical pillar type switchboard for 3,000 volts. The sectional view, it will be noted, indicates the arrangement of the bus-bar chambers, and the positions of the main oil circuit-breaker and dividing box. In an alternative scheme of bus-bar chambers isolating plugs are employed.

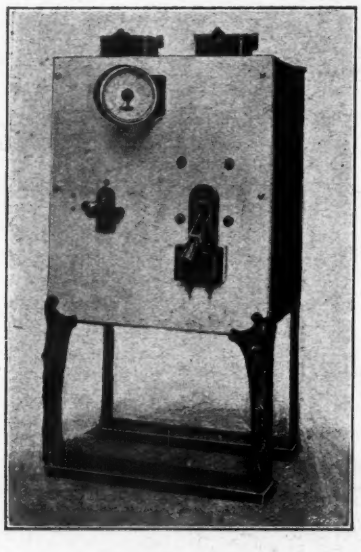


Fig. 14.—Three-phase Above-Ground Colliery Motor-Control Panel for 3,000 Volts. (Front View.)

Fig. 13 illustrates a similar board arranged for circuits of small power 600-volt service, in which quick-break knife switches and enclosed fuses or automatic oil-break switches are employed.

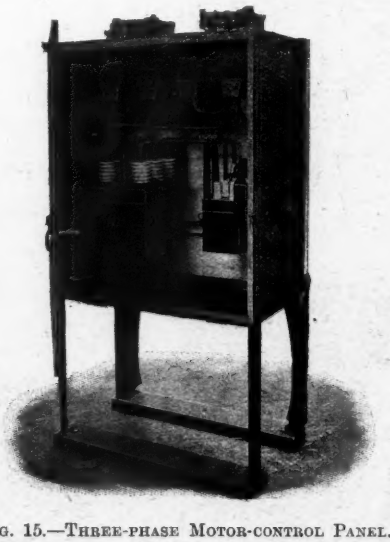


Fig. 15.—Three-phase Motor-control Panel. (Back View.)

Motor-control Gear.—Above-ground (panel type).—A typical motor-control panel for 3,000-volt three-phase work installed above ground is shown in figs. 14 and 15. It will be noted that the same general scheme of protection is adopted here as in the case of the main board shown in fig. 10. The enclosing box forming the compartment at the rear of the panel is made of sheet iron.

A panel type of motor-control board for low and medium voltages is also constructed. This panel is provided with an ammeter, quick-break switch of a pattern in which all "live" metal is at the rear of the panel, and the necessary enclosed-type fuses. The rear of the panel is entirely closed in by a metal screen, provided with a suitable door so that all apparatus is readily accessible. This panel is carried on a suitable supporting frame, and is provided with means for bracing from a wall.

Underground (panel type, 3,000 volts).—The motor-control panel for this service is similar to the panel described for service above

ground, except that the rear door is of solid sheet metal, and the handles of the main switches are provided with suitable covers to prevent dust from entering the compartment through the slots in the panels through which the switch handles project. These covers are hinged to the board, and are opened when it is desired to get at the switch handle.

(To be concluded.)

THE OLYMPIA ELECTRICAL EXHIBITION.

(*Continued from page* 711.)

Veritys, Ltd.

It is somewhat difficult to deal with the exhibit of Messrs. Veritys, Ltd., comprising as it did a range from an electric kettle to a 30-h.p. motor. Beginning with the fittings, various styles were shown, including special "Waldorf" and "Comedy" patterns, "Adam" and "Nouvean Art," Chippendale and Versailles lanterns accurately copied from the originals, and very costly, and the "Edwardian" series of fittings, in which the same pattern is repeated in brackets, electroliers, &c. We illustrate herewith the Chippendale lantern and an Edwardian pendant. A variety of radiators was shown, including one which was claimed to be the largest stocked, containing six lamps, divided between two circuits, and taking 1½ kw. This would warm a room 30 ft. square. Another radiator was of aluminium, a new line which Messrs. Veritys have introduced, and one, which we illustrate, was round, with a table top, to keep a teapot warm, for example. Some very cheap radiators were included, and one which, paradoxically, could be used as a radiator in winter, a fire-screen in summer. Hammered iron lanterns and oriental fittings, a glass ceiling fitting, a convertible bracket or table lamp with a switch in the base, and a fitting provided with Britelite lamps and silvered reflectors throwing the light on the ceiling, can only be mentioned.

An electrically-heated tray and hot-air spray for drying ladies' hair formed an interesting exhibit; two patterns were shown. In the cooking demonstrations, we were informed, the whole of the utensils were of Veritys' Aston "Electra" pattern, and a large variety was displayed on the stand. An electric geyser, which, taking 600 watts, heats enough water for a bath in 15 minutes, showed that there is practically nothing left in which gas cannot be replaced by electricity. On another part of the stand were 12-in. spark coils for wireless telegraphy and X-rays, a neat electric indicator for motor-cars, to convey orders to the chauffeur, the Knoxem factory bell, and standard telephones in great diversity.

The remainder of the exhibit was devoted to heavier work. A series of nine machines of the new "Aston" type, consisting of a motor driving a dynamo, which in turn drove a motor, and so on all round the stand, ranged from 30 h.p. to ½ h.p. The "Aston" arc lamps round the stand were fed from the first dynamo. An 8-kw. dynamo, fitted with a long commutator for the Indian climate, and running at 500 r.p.m., was shown coupled to a Reavell engine. Other items were a Haigh refrigerator, driven by a 2-h.p. "Aston" motor; a portable motor-driven air-compressor; the new "Excelsior" high speed pump, and a variety of starting switches and controllers of all sizes. We have already mentioned that 180 of Messrs. Veritys' arc lamps have been permanently installed to light Olympia; others were shown on the stand, and their new arc lamp suspension gear, which we have already described. We illustrate a new reversing crane controller and a single-enclosed arc lamp.

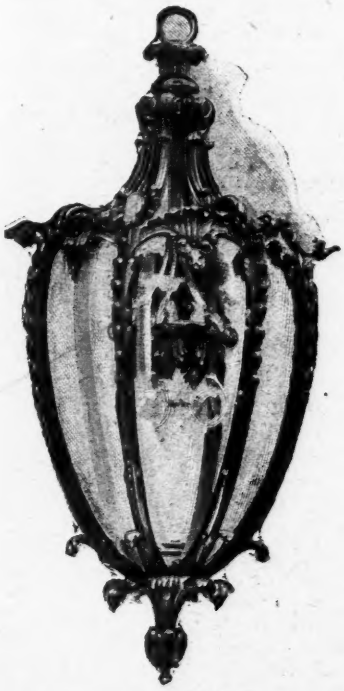


Fig. 138.—Chippendale Lantern.

Fig. 141.—Aston-Worsley Arc Lamp.

Fig. 139.—Kettle-drum Radiator.

Fig. 140.—Edwardian Pendant Fitting.

Fig. 142.—Crane Controller.

Pope's Electric Lamp Co.

Messrs. Pope's exhibit dealt exclusively with their various lamp specialities; samples of the lamp in its various constructional stages were on view, and the firm's new patent candle was specially prominent. In this device, the opal tube is separate from the candle lamp, and can be removed from the latter by unscrewing a washer on the lamp cap.

An excellent imitation of a transparent wax candle is obtained, and the burnt-out lamps are allowed for if returned to the makers.

John Barker & Co.

Messrs. John Barker, who are London agents for the Kennedy Patent Bending Machine, were showing several sizes of the latter at their stand in the gallery.

The machine is specially adapted for bending cold, gas, steam and hydraulic pipes, flat iron and steel on edge, angles, tees, &c.; its simple construction is evident from our illustration, fig. 143, of a double lever (No. 2) machine, which will deal with 1 in. copper, brass or iron tubing.

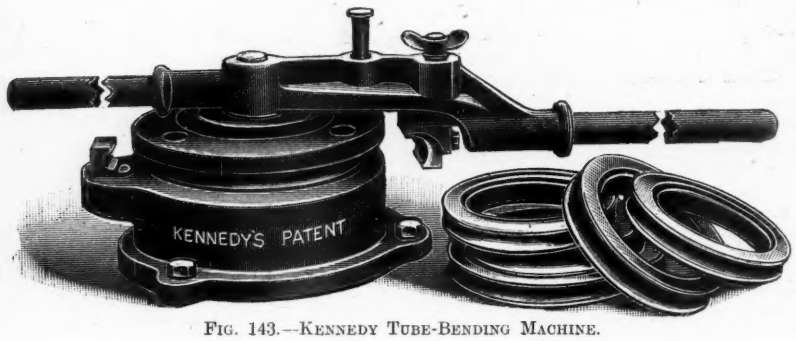


Fig. 143.—Kennedy Tube-Bending Machine.

The loose rings shown are dies of varying radius for effecting the several sized bends; the three sizes of machine will deal with tubing of from ⅛ in. to 2 in. diameter.

Selig, Sonnenthal & Co.

An imposing array of machine tools was displayed by this well-known firm, many of the machines being in operation, driven through belts and countershafting by an electric motor. Passing over the standard tools, with which most engineers are familiar, we shall draw attention to two novel devices, which we illustrate herewith.

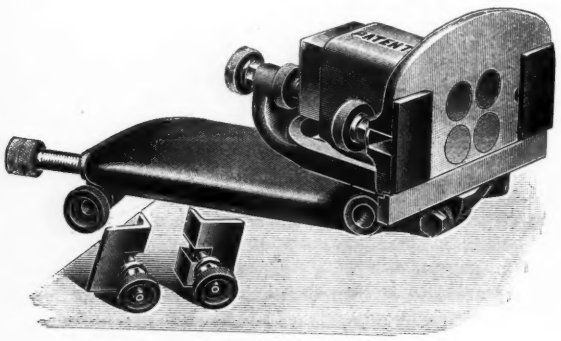


Fig. 144.—Wireless Magnetic Work-holder.

The first is an ingenious wireless magnetic work-holder for iron and steel articles (Dudgeon's patent), made of aluminium for the sake of lightness, and provided with four steel permanent magnets, whose faces are flush with that of the holder. By means of this device, besides thick articles, pieces of the thinnest material, which it has hitherto been impossible to handle, can be accurately ground on a disk grinding machine with ease. The holder is adjustable to any angle, and is moved towards the disk by hand, an adjustable stop screw being provided to ensure uniformity in the thickness of the work. The figure shows the holder arranged for very thin articles; when dealing with thicker ones, the high stops (to prevent lateral motion) seen at the side are substituted for the thin ones, and the bottom slide is moved forward.

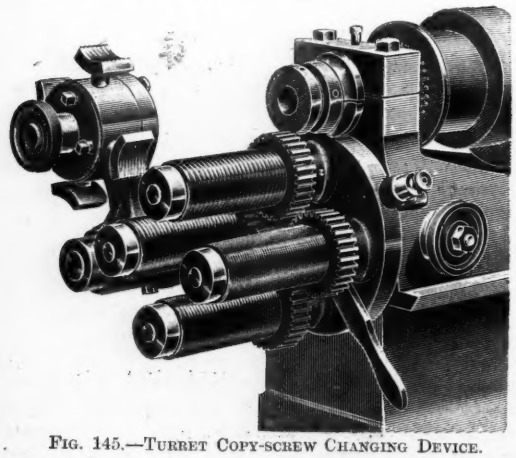


Fig. 145.—Turret Copy-screw Changing Device.

The second illustration, fig. 145, shows an excellent time-saving device, in the shape of a pair of turrets fixed on the end of the headstock of a lathe, and carrying four copy screws and followers of different pitches. Any one of these screws can instantly be brought into gear with the corresponding follower, and only the one in use is kept in motion. The screws and followers may have any desired pitch, being easily changed, and both right and left-hand screws can be cut with the same copy screws, by means of an arrangement provided for this purpose. The chasing slide is similarly fitted with a turret to carry four chasing tools, which are instantly changed. The device was shown fitted to the firm's patent Universal Monitor brass-finisher's lathe.

Another item was a double radial sensitive drill, each drill-head being independent of the other; and on a separate stand were braiding machines for covering electrical wires, &c., and a variety of tools and accessories.

The "Imperishable" System of Underground Mains.

In an earlier issue we referred to the stand of the Steel Core Conduit Co., Ltd., who also had on view examples of the "Imperishable" system of underground mains, for which their conduit is specially adapted. Needless to add that the system seeks to avoid the very high capital expenditure which distribution networks have entailed in the past.

The conductor, a bare one, is threaded through suitable ring insulating supports, held in position by special clips, and placed at close intervals in the bottom of the trough. The insulators are threaded on to the conductor as it leaves the drum. A separate duct is used for each conductor in order to obtain certain insulation, and is filled with insulating compound in the usual way.

Fig. 146.—"Imperishable" Mains.

The arrangement is calculated to prevent decentralisation of the conductor within the bitumen, and its simplicity and cheapness are much in its favour.

The Efandem Co.

This company was showing a variety of electrical novelties, prominent among them being "wireless" signs, voltage regulators, electric door openers, patent terminals, ignition dynamos, &c.

In the case of a wireless sign consisting of letters, each of the latter consists of a front and rear plate of polished nickelled brass, these being attached to carrying bars; the two systems of plates and bars are insulated from each other, and the former act as terminals for the small illuminating lamps used for delineating the letters on the sign. The lamps are provided with both a screwed cap and a plug, for connecting to the front and rear letter plates respectively.

A pressure of 10 volts only is required for the sign, which, for this reason, can be safely used and handled; and as the letters are held in position by spring clips only, the wording can be readily changed.

Haines & Co.

Fire protective devices for power stations, which included portable chemical extinguishers, hand-pumps, the "Handy" bucket tank, the "Cliff" safety patent automatic fire hose reel, &c., were

shown on this firm's stand. The Cliff hose reel can be recommended to those in search of up-to-date fire equipment. It consists of a flat reel of canvas fire hose, one end of which is connected to an ordinary screw coupling in the centre of the reel; the other end to the nozzle.

In case of fire the nozzle is drawn towards the flames, unwinding the reel, which, as it revolves, automatically opens a valve, allowing water to discharge through the hose when it is nearly unwound. For a 50-ft. hose some 8 seconds, and with a 100-ft. hose some 13 seconds only, are required to put the hose in operation.

This firm were also showing their "Torridite" specialities, comprising sectional moulded steam-pipe covering and high-pressure jointing material.

J. Defries & Sons, Ltd.

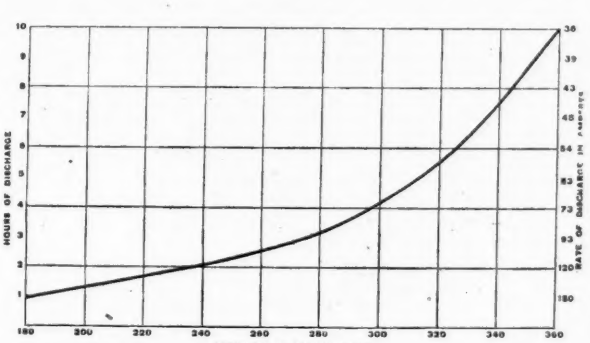
Messrs. Defries's exhibit included a comprehensive display of Stewart arc lamps, of which numerous patterns were on view. The firm are makers of the Wirt field rheostats, Wirt theatre dimmers, and the well-known Wirt brushes for dynamos and motors, and these were also shown on the stand.

(To be concluded.)

GERARD & FIEDLER STORAGE CELL.

We recently paid a visit to the workshop of Messrs. Gerard and Fiedler, at 22½, Cazenove Road, Stoke Newington, to see a new accumulator which they are making and for which high qualities are claimed. The plates of this cell are in several respects widely different from any that we have previously seen. They have been devised for traction purposes, with a special view to securing a large output per unit of weight, large capacity and rapidity of charge and discharge, and we understand that these results have been obtained to a remarkable degree; we are informed that a H.P.-hour can be obtained from a cell weighing only 16 kg., an output equivalent to more than 21 watt-hours per lb.—a figure hitherto, we believe, unapproached.

The capacity of a cell weighing 16 kg., discharging at the rate of 36 amperes, is 360 ampere-hours, and this, it is claimed, would enable an electric motor-car equipped with a battery of such cells to travel no less a distance than 180



Curve of Capacity with Different Rates of Discharge.

miles on one charge. Such a revolutionary proposition, of course, must be put to the test on the road, but even the claim is extraordinary. Further, the makers are prepared to charge the battery in a period not exceeding two hours, without any ill effects. It is not proposed to limit the application of the battery to motor-cars, though this is the primary object of its existence; it will, of course, be equally applicable to heavy traction, stationary lighting and other work. Freedom from sulphating and buckling of the plates are amongst other advantages claimed.

We give herewith a diagram supplied by the makers, showing the capacity of a 19-plate cell (plates 215 × 125 mm.) at various rates of discharge. The weight of the electrodes was 13·3 kg. It will be seen that even when discharged in one hour, the capacity is not less than half the full 10-hour capacity. This is the "standard traction cell," with plates made by machine.

Another noteworthy point is that the ampere-hour efficiency remains practically constant, no matter what rate of charge and discharge is adopted. We have seen a report issued by the National Physical Laboratory giving the results of tests made on a small Gerard & Fiedler cell, in this instance with hand-made plates. The tests were performed with a view to ascertaining the ampere-hour efficiency at (1) the normal rate, 5 amperes charge and 10 amperes discharge, and (2) the abnormal rate of 40 amperes charge and discharge. In each case the cell was first charged and discharged 16 times, between the limits of 2·40 volts E.M.F. at end of charge and 1·80 volts E.M.F. at end of discharge.

The corresponding charging pressures were 2·65 volts at 5 amperes, and 2·90 volts at 40 amperes. The cell weighed 12·8 lb., and had five plates, 215 × 125 × 4 mm. The results were as follows:—

	Normal rate.	1-hour rate.
Rate of charge... ...	5 amps.	40 amps.
Rate of discharge ...	10 amps.	40 amps.
Average input... ...	68 amp.-hrs.	42·25 amp.-hrs.
Average output ...	64·6 amp.-hrs.	40 amp.-hrs.
Efficiency (amp.-hr.) ...	95 per cent.	95 per cent.
Total watt-hours ...	126	70·4
Watt-hours per lb. ...	9·85	5·5

Estimating the net weight of the electrodes at 7·7 lb., the energy output per lb. of electrodes was 16·4 watt-hours, and 9·2, in the two cases. The tests, however, were made on a small hand-made cell, and consequently are not comparable with tests made on the standard size machine-made cell referred to above, in which the plates are much improved, and constitute 83 per cent. of the total weight, as compared with 60 per cent. in the small cell.

A still higher ampere-hour efficiency is also claimed for the standard cell.

The plates are of the pasted type, and though we may not speak of the composition of the paste, we may say that each plate consists of a stout leaden grid containing 15 square apertures. The paste is compressed into these spaces by means of a machine, which at the same time leaves a large number of small holes through the blocks of paste, and one larger hole in the centre of each block, thus providing for free circulation of the electrolyte. Celluloid separators of special design are inserted between the plates to prevent short-circuits. Positives which had withstood a year's hard work were shown to us, and appeared to be in excellent condition. Indeed, long durability is a special feature claimed for both positives and negatives.

An opinion not based upon long personal experience of the behaviour of a storage cell is worthless, and therefore we cannot venture to comment upon the merits of the cell. We hope, however, that it will shortly be submitted to thorough trial on the road, and, in the interests of the electrical industry, that the remarkable claims put forward may be fully substantiated.

CORRESPONDENCE.

Letters received after first post on Wednesday morning cannot appear until the following week. Correspondents should forward their communications at the earliest possible moment. No letter can be published unless we have the writer's name and address in our possession.

Hygienic Telephones.

Without wishing in any way to enter into *useless* controversy on the above matter, I feel unable to allow Mr. Newell's letter of criticism to pass, without some comment on the subject.

To begin with, I think it is pretty well understood that the object of the special mouthpiece is to *prevent the accumulation of moisture, dirt and disease germs* (consumption, for instance), and many points in support of this claim, appear to have been entirely disregarded by Mr. Newell, in spite of the fact of his claiming to be "a purely disinterested writer" and a "telephone expert."

Considering the question of *moisture*, in using the "hygienic" combination, the mouthpiece of the microphone is absolutely away from the mouth and nostrils of the user, and as the breath comes from these latter in an outward direction, it is obvious that little, if any, finds its way (round the corner as it were) into the aforenamed mouthpiece.

Let anyone try the simple experiment of placing his hand a little distance from the front of his mouth while speaking, and again at the side of his cheek under similar conditions, and the difference will not take much finding out.

Respecting the accumulation of *dirt*, the mouthpiece having a smaller opening than the ordinary pattern, there is comparatively less likelihood of dirt getting in, in the first instance. Further, every time the combination is hung on the hook the dirt has a tendency to shake out by virtue of the smooth interior affording no hold, and also by the fact of its being hung pointing continually downwards.

"Pathogenic germs" have to be dealt with, and here again the instrument most assuredly scores. I should very much like to see the "proper condition" for a cold, smooth, metal tube or mouthpiece to become "a species of culture tube for the germs to disport themselves in and to multiply," as Mr. Newell puts it. Could a more suitable (being practical) material be chosen? Not that metal mouthpieces are a new idea by any means, but whilst the advantages of metal are retained, the disadvantage in the shape of "twangy" conversation has been overcome by jacketing the metal with a substance, which not only improves the aconstic properties, but also greatly enhances the appearance of the instrument.

Speaking of customers' choice, I fail to see that a mouthpiece of "fairly accessible nature" would appeal to the sympathies of a business man, insomuch that in many cases the fracture of a poorly-protected microphone disk by little fairies, to wit, office boys, has been the cause of much *unhealthy* language.

"A long, deep and narrow mouthpiece," apart from its "fool-proof" characteristics, is infinitely preferable, as (if desired) it may be cleaned without much fear of damage to the microphone, by any person afflicted with "anti-germ mania"—but I don't think there are many about.

Respecting the cases of priority of patent, Mr. Newell omits to mention whether the persons referred to brought the idea out with *a claim of having hygienic properties*.

If not, it has only been merely a patented design, and not a patented improvement on the lines suggested.

'Tis said, "There is nothing new under the sun," and, after all, it is in the *fitting or suitability* of application of an instrument to its designated purpose wherein lies the merit and value of an invention.

The action of the G.E.C. is sufficiently suggestive. "Imitation is the sincerest form of flattery."

I do not pose as an "expert," but only as an "observer," and in the majority of cases that have come under my notice (including a trial even in collieries) the general impression has been that this is a "sterling" instrument in more senses than one.

In conclusion, I might add that I am "a purely disinterested writer" to the extent of having no connection with any firm manufacturing telephones. Can Mr. Newell truthfully say the same?

Expressing my indebtedness to the Editors for allowing another "side" to appear.

J. R. Parkington.

Swansea, *November 6th*, 1905.

It appears to us that the sole object of your disinterested correspondent, Mr. A. G. Newell's letter on the 31st ult., is to cast doubt upon the novelty of the patent under which our hygienic telephones are made. We would point out to him that from first to last we have not claimed to be the first inventors of a telephone with a hollow handle which also serves as a sound director. In our opinion Mr. Newell's anxiety to bring the subject forward is out of place, and has nothing whatever to do with the points at issue. We may, however, inform him that we are well acquainted with the patents mentioned by him, and others, which he appears to have overlooked.

pp. **The Sterling Telephone and Electric Co.**
I. B. Birnbaum, *Manager.*

London, *November 7th*, 1905.

Regenerative Control.

In reference to the letter of "R. H. C. B." in your last issue, may I ask why he does not advance something more definite against separately-excited or shunt-field control of motors than the statement that they take exceedingly heavy currents for starting and accelerating. Surely this could be remedied by the insertion of a suitable resistance in the armature circuit, cutting this out as the car gains speed.

The range could be gained with just as little complication as he uses. An ordinary shunt system of control, such as is used for the control of printing presses, lathes, planing machines, &c., should be quite as successful in controlling cars.

I think, if I remember rightly, that at the recent Olympia Exhibition I saw a planing machine operating on a load varying from 7 to 55 tons, without sparking or straining in any way, and reversing four times a minute. This cycle of operation can be kept up for many hours without deteriorating the motor in any way.

Taking this into consideration, I really cannot see why a properly designed system of control should not be more successful than series motors of any form whatever for carriages, tramcars or railway coaches.

In conclusion, I may say that I think series motors should have been obsolete a decade ago.

L. E. J. C.

As no one has so far made uncomplimentary remarks regarding your article on the above subject on October 27th, may I be allowed to repair the omission?

When you see a well-known embrocation advertised to cure all the ills to which flesh is heir, you begin to doubt if it is any use for sprains—and when one reads the above-mentioned article one begins to doubt the "facts" so freely referred to.

I only wish designers could find such convenient facts.

Only to-day, for instance, I found a shunt which evidently had not heard of the new order of things, and which persisted in occupying 30 per cent. more space than the corresponding series winding.

Your contributor seems to have overlooked something in the last paragraph, where he says that at the same speed a shunt motor is better, if anything, than a series motor, the armature being the same. Perhaps the load makes a difference?

A series motor will run at a high speed only on light load, and because of the light load, but what guarantee have we that the operator will not make his motor attempt maximum torque on top speed?

Perhaps this accounts for the "fact" that a series motor will do without injury for short periods three times the work that a shunt motor can manage.

When attendants are superhuman, perhaps shunt motors with variable speed may be worked satisfactorily for traction and haulage.

Crane.

[We welcome our correspondent's letter, as we should welcome any other criticism equally fair. As he says, a system with which *no* fault could be found, would be a little too good for this world. The only way in which a heavy torque can be applied at top speed, appears to be by charging a very steep gradient. This is successfully accomplished by the shunt motor. A car equipped with two 40-H.P. regenerative motors ran up the well-known "Shoulder of Mutton" Hill, taking 120 H.P. (measured), without injurious effects. What more is necessary? Referring to our correspondent's *nom de plume*, we wonder if he is aware that regenerative shunt motors have been used for heavy crane work for some years, with complete success?—Eds. E.R.]

Lead-Covered Wiring.

I am pleased to see that lead-covered wiring is occupying the attention of many engineers at present, which, I consider, is a step in the right direction, after my 12 years' experience in all systems of wiring, especially twin lead-covered and concentric lead-covered. What is really wanted is a systematically systematised system, with standard fittings and threads which can be erected inside a finished building, without damaging or defacing the walls or ceilings, and remain damp-proof after erection.

This system is only to be found in twin lead-covered, and I have no hesitation in supporting your other contributors

in favour of this system. Usually City engineers are so conservative in their own ideas, that it is almost impossible for a contractor to improve his methods; if they try to do so their efforts are met with discouragement, and it means time and money to assemble anything like a perfect system, which the profits from wiring can hardly afford.

I have read with much interest Messrs. H. Bailey & Co.'s system of erecting lead-covered wiring, but I can't say that I ever found any difficulty in the bonding and earthing of the lead sheathing, and it is a mistake on their part to think that single lead-covered wire can be erected more economically in houses than twin; regarding the running of $\frac{5}{8}$ tubes down walls, I think it is hardly necessary, as I have run miles of wire cleated to the wall, which was coated over with plaster afterwards, and is standing to-day without having cost a penny for repairs, except in two instances where nails had been driven. But I wish to point out that the chances of nails being driven in are very small, owing to the position of switches.

Vulcanised india-rubber insulation is preferable to paper insulation; not only is this latter insulation hygroscopic, but it is very liable to be damaged in the jointing, and it is absolutely essential that the lead-covering be of a certain thickness, otherwise it is liable to be cracked in the erection.

Referring to Mr. Stevenson's letter of the 30th ult., it is very useful to know the exceptional cases in which lead-covered wiring failed, although in all my experience I never found foundry gases to destroy lead covering. As far as calico works are concerned, I think a more ideal system could not be erected, as there is so much water and steam about them. The only place in a calico works where the lead is likely to be attacked is confined to the mixing room, where the colour is mixed, and this only applies to a certain colouring matter, which no class of wiring will stand except bare copper stretched on insulators. Mr. Stevenson would further point out that lead-covered wiring will not stand outdoor work; in this I also disagree, although Mr. Stevenson has had much reason to complain, but probably the fault was due to the method on which it was erected.

System.

I am much obliged to your correspondents for their interesting letters respecting the above subject, but regret I cannot altogether agree with the views expressed by Messrs. Tyler & Freeman and H. Bailey & Co., as I have found several cases of breakdown with both paper-insulated and V.I.R.-covered wires, and in almost every instance it has occurred at ordinary easy bends; from the granular appearance of the lead sheathing, it gave one the impression that some electrolytic action had taken place, possibly due to the lead sheathing being porous, one case being in the wiring of an ordinary printing works, another in a cold storage warehouse.

I understand from Mr. Stevenson's letter that he considers twin paper-insulated wire advantageous "for house wiring and dry and unexposed situations generally." If I understand him aright, will he be good enough to explain in what way he considers the system more satisfactory than a properly carried out steel conduit system? This, I judge, is the crux of the whole matter.

I hoped in raising this subject to hear the views of some of the leading steel conduit enthusiasts; and, providing the discussion is not trespassing on your space too much, I still hope to hear that they are not content to take the matter "lying down."

Cecil R. Whipple.
Whipple & Co.

Liverpool, *November 7th*, 1905.

Your last correspondent has interpreted our letter just a little too literally.

At the time of writing we had in view the wiring of houses, shops, warehouses, &c. Of course we quite recognise that there are some cases where this system would be entirely unsuitable, and in these cases we should not be so foolish as blindly to recommend lead-covered wire, simply because we happen to specialise in it.

We were perhaps a little too indefinite in our assertion, but what we endeavoured to show was that there was undoubtedly a field, and a large one too, where lead and paper wires could with advantage replace vulcanised rubber.

H. Bailey & Co.

Accrington, *November 7th*, 1905.

Colliery Switchgear.

A very interesting article appears in your present issue regarding switchgear for mining plants, but after reading the same, one wonders in what respects (or even respect) the switchgear and switchboards manufactured by the company whose name is given, differ from other manufacturers' standards.

Had the article described in a general way only what switchgear is made by the various manufacturers for mining purposes and to comply with the Home Office rules, your readers would have perused the description to discover points worth knowing; found there were no such points, and turned their attention to other of your columns from which genuine information could be obtained, but one is led to believe that the switchboards described receive more attention regarding design from one particular firm than from the sum of the remaining switchboard makers.

I venture to say that it is impossible to walk into the shops of any eminent firm who undertakes this class of work without seeing switchboards which agree in almost every minute detail with those illustrated and described in your present issue. There is absolutely nothing in the text or illustrations that we have not seen embodied in H.T. and E.H.T. switchboards for a number of years past, although perhaps the application of such boards to mining work may be somewhat new.

It is interesting to notice that the marble panels have "neat bevelled edges," but it is doubtful as to whether this would prove the apparatus to be more efficient under abnormal, or even normal, conditions. Also the current transformers are "highly insulated," and the porcelain insulators supporting the bus-bars are "high grade." Surely these conditions are fulfilled, no matter by whom the switchboard is constructed.

In short, the article describes switchgear which is standardised by almost every switchboard maker in this country, also by some Continental manufacturers, and one can almost imagine when reading Mr. Randolph's remarks that it is a consulting engineer's specification—the remarks being so general.

Switchboard engineers are probably awaiting with breathless interest the further disclosures which, presumably, will be made in the continuation, and may I suggest that the panel thicknesses may be stated or dimensions of the bevelled edges, and particulars of the holding-down bolts be given, so that other manufacturers may have an opportunity of bringing their standards into line with those described by you.

D'Nar.

[It is a pleasure to know that our correspondent is already so well informed that he can gather no new ideas from the "very interesting" article in question, describing the modifications necessary to adapt existing types of H.T. switchgear to the special conditions obtaining in colliery work, an application which he considers "may be somewhat new." We gather, however, that he objects to the name of the firm that is mentioned, and he goes out of the way to draw the quite illogical inference that that firm pays more attention to colliery switchgear than all the remaining switchboard makers!

A man must write of that which he knows best, and at the same time he must give due credit to the makers of what he describes. Our correspondent is perfectly at liberty to criticise the article, but his criticism should be fair.—Eds. E.R.].

Mulholland v. Hammersmith Borough Council.

Your report of the above case has just come into my hands, and though the facts are, unfortunately, too lengthy to trouble you with in detail, there are several points that I should be glad of an opportunity of making clear. The reductions "by mutual agreement" previous to action did not arise from a faulty meter at all, but from the fact that a

deliberate overcharge was made by the Corporation, till the "mistake" was discovered, after which an endeavour was made to still continue charging for alternating current supplied to, instead of, as agreed, continuous current supplied by, the motor-generator; but ultimately an "allowance" of £14 11s. was made, then increased by a further sum of £13 2s. 3d., and finally increased in Court by the Judge by a further sum of £16 3s. 8d., the amount that my client had throughout contended for, so that the overcharge in an account of between £80 and £81 amounted to no less a sum than £43 16s. 11d. The result was to leave a judgement against my client for £36 13s. 7d. and costs, which amount was admitted, subject to the counterclaim.

As to this portion of the case, it will perhaps not surprise your readers to hear that, in addition to endeavouring to shelter themselves behind the Public Authorities' Protection Act, the plaintiffs argued that though there was a contract by Mr. Mulholland to take the electric light from a certain date, yet they had never contracted to supply it. The conclusion of this interesting case was that the plaintiffs withdrew their judgement, thus admitting in the result the justice of the counterclaim, and as the costs of the claim would have had to be set against the costs of the counterclaim, each party paid their own costs.

J. Moverley Sharp.

London, S.W.,
November 6th, 1905.

Municipal Wiring.

I have read with interest your correspondent's letter in your issue of October 27th. I quite agree with his views that a local authority should not carry out municipal wiring by their own staff, but that this work should be left to wiring contractors in the district.

At the same time it would considerably help municipal electric lighting stations if some system of wiring could be carried out in conjunction with contractors, and I should be very glad if your correspondent would send me particulars of the Huddersfield scheme as soon as it is formulated.

I happen to be Chairman of the Electric Lighting Committee of an Urban District Council, and am, therefore, very much interested in the matter, but as far as Urban District Councils are concerned, they have no power to enter into any arrangement of this kind, as any loss which might be incurred on such a scheme would be surcharged to any of the councillors who signed cheques in connection therewith.

If you know of any case in which an Urban District Council has made an arrangement on lines which would be fair to wiring contractors, I should be very much obliged if you would kindly give me particulars of such arrangement.

Alfred Slatter.

London, *November 1st*, 1905.

BUSINESS NOTES.

Fire Alarm.—Last week a fire occurred at the Royal Hotel, Avonmouth, Bristol. The whole of the occupants—25 in number—were saved by the prompt warning given by the Pearson electric automatic fire alarm which had been installed in the building, and which aroused the manager. By the aid of the brigade the fire was confined to the bar. When the manager was wakened by the alarm the upper floors, which are approached by a single staircase, were filled with smoke.

Bankruptcy Proceedings. — R. Pries. — At last Friday's sitting of the London Bankruptcy Court, Robert Pries, electrical sundriesman, lately trading at 75, City Road in the name of Dartnall & Pries, attended before Mr. Registrar Brougham in relation to his public examination. Mr. Walter Boyle, Assistant Receiver, reported that the debtor had been away in Germany, but had been examined by the department in the preliminary stage. The statement of affairs had not yet been lodged, but he understood that the debtor proposed to file it that day. Replying to his Honour, the debtor said his father died in July, and he had since managed the business in Germany for his mother. He had completed the statement of his affairs, and would lodge it without delay. As he had to return at once to Germany to conduct his mother's business, he asked for the public examination to stand over until the next sitting. After some discussion, the learned Registrar ordered the hearing to be adjourned to January 26th next.

H. J. C. Somerville.—The adjourned first meeting of creditors was held before Mr. E. S. Grey, Official Receiver, last week, under the failure of Henry J. C. Somerville, 109, Victoria Street, Westminster, engineer and adviser on patents, who was interested in the promoting of the Otto Electrical Manufacturing Co., Ltd. The Chairman reported that a statement of affairs had been filed showing liabilities £3,751 9s. 6d., against assets valued at £8,303, and including book debts £7,000. The debtor claimed £2,500 for unpaid commission from Messrs. Emerson Bainbridge & J. M. Catton, the promoters of the Nelson Share Syndicate. He (the Chairman) thought it was a surprising thing that a man, owing between £3,000 and £4,000 and possessing assets valued at between £8,000 and £9,000, should not be able to pay his debts. He could only come to the conclusion that the value of the assets was problematical, and in due course he would apply to the Court for an order of adjudication under which to wind up the estate in bankruptcy. No resolutions being passed, the case remained in the hands of the Official Receiver.

Thomas Hill.—Under the failure of Thomas Hill, electrical engineer, of 24, Vicarage Road, Wolverhampton, and formerly of Stafford Street, Willenhall, the accounts showed gross liabilities amounting to £178, assets valued at £13 11s., and a deficiency of £165. The causes of failure given by the debtor are: "Depression in trade, bad debts, and loss on contracts." He commenced business in 1900 at Willenhall, with a capital of £40. The Official Receiver remarks that the debtor holds no certificate as an engineer, but states that he has had practical experience in an ironfounder's fitting shop.

Ernst Emil Donat (Donat & Co.), mechanical engineer and agent, Spring Gardens, Manchester and Withington. Order made October 31st at Manchester Court.

Dissolutions and Liquidations.—British Electric Signs Co., Ltd.—Creditors are to send particulars of debts, &c., to the liquidator, Mr. G. Ensor Mount, Dashwood House, E.C., by December 8th.

Paul Heater and Condenser Co., Ltd.—Creditors are to send particulars of debts, &c., to the liquidator, Mr. Hugh Beswick, 7, Sweeting Street, Liverpool, by December 2nd.

Virginia Electric Co., Falcon Works, Virginia Street, Southport.—Messrs. G. A. Rowland and W. Robinson have dissolved partnership. Mr. Robinson will attend to debts.

British Miller Signal Syndicate, Ltd.—The company is winding up voluntarily, with Mr. E. H. Stringer, 110, Cannon Street, E.C., as liquidator.

Morrish, Tumber & Co., electrical engineers, plumbers, &c., Linthorpe Road, Middlesbrough, and York.—Messrs. J. M. Morrish and E. Tumber have dissolved partnership. Mr. Morrish will continue the business and attend to debts.

British Pioneer Electric Light and Power Co. of India, Ltd.—A petition, presented by S. T. Biggs and C. R. Sawyer, shareholders, for winding up this company, is to be heard in London on November 21st.

For Sale.—The factory premises at Reading, also plant, patent rights, &c., of the Industrial Storage Battery Syndicate (in voluntary liquidation), are to be offered for sale on November 28th. For particulars see our advertisement pages to-day.

Claim against a Tramway Company. — In the Edinburgh Court of Session, an action is to be tried in which Matilda Andrew sues the National Electric Construction Co., Ltd., for £2,000 damages for the death of her husband, retired inspector of police, who was killed by one of the company's tramcars jumping the points and crushing him against the wall at the car terminus at Levenhall. The plaintiff contends that the car was being driven at excessive speed, and that the driver failed to keep it under control and to observe that the points were locked. Defendants admit the collision, but deny responsibility.

Book Notices.—"Les Quantités Elementaires d'Electricité: Ions, Electrons, Corpuscles." By H. Abraham and P. Langevin. Parts I. and II. Paris: Gauthier-Villars. 35 fr.

"The *Practical Engineer* Electrical Pocket-book for 1906." 1s. net (leather, 1s. 6d. net). "The *Practical Engineer* Pocket-book for 1906." 1s. net (leather 1s. 6d. net). Manchester and London: Technical Publishing Co.

"Synchronous and Other Multiple Telegraphs," by Albert C. Crehore. New York: McGraw Publishing Co. $2.00.

The Diesel Engine.—The 500-B.H.P. Diesel engine exhibited at the Liége Exhibition has been awarded the "Grand Prix." At a recent test carried out by the purchasers of this engine, the extremely low figure of ·38 lb. per B.H.P.-hour was obtained for fuel consumption at full load. This, with oil at 42s. per ton, represents a fuel cost of 0·096d. per B.H.P.-hour, or 11½ B.H.P.-hours for 1d. The Diesel Engine Co., Ltd., of London, have recently secured an order for an engine of this power (500 B.H.P.) to drive the new extension of the works of Messrs. Craven and Speeding Bros., Sunderland, where a small Diesel engine of 240 B.H.P. has been used to drive the existing works for nearly two years. Among other contracts recently obtained by the Diesel Engine Co., Ltd., are the following:—

150-B.H.P. for Messrs. Bartram & Sons, Sunderland.
225-B.H.P. for Messrs. Binny & Co., Madras.
160-B.H.P. for Messrs. Bradbury, Brady & Co., Bombay.
400-B.H.P. for Messrs. Bradbury, Brady & Co., Bombay.
90-B.H.P. for Messrs. Gibson, Battle & Co., Sydney.
Two 33-B.H.P. for Guildford Electric Lighting Co., Australia.
Two 20-B.H.P. for Messrs. Haupt, Biehn & Co., Rio de Janeiro.

Royal Tour in India.—We learn that H.M.S. *Renown*, the ship in which their Royal Highnesses the Prince and Princess of Wales are proceeding to India, is fitted with one of the Pulsometer Engineering Co.'s "Lapwing" ice machines on the ammonia compression system, this being one of a large number supplied to the Admiralty.

Catalogues and Lists.—Messrs. Mavor & Coulson, Ltd., Glasgow.—The monthly card for November shows diagrammatically a difficult seam, in which one of their Pick-Quick electric coal-cutting machines did good and efficient work. The conditions were exceptional, in that the holing was done in strong fireclay, between which and the coal there was a strong band of friable sandstone. This sandstone collapses immediately on being undercut, and a machine of the Disk type was unsuitable.

Messrs. Willans & Robinson, Ltd., Rugby.—New eight-page pamphlet containing a general description of the Niclausse patent water-tube boiler, with some excellent views and diagrams, showing its construction; details of the header and tubes, caps, plugs, &c.; and a sketch indicating the direction of the circulation of water in the tubes.

The Electrical Installation Maintenance and Construction Co., 10 and 11, Cursitor Street, Chancery Lane, W.C.—Pamphlet detailing the objects of the company, and its terms for periodical inspection and maintenance of electric lighting installations. A table of revised prices of four makes of incandescent lamps is given.

Messrs. G. Davenport & Co., 108, Hatton Garden, E.C.—Catalogue relating to impregnated foundation felt for reducing vibration and sound. It is employed as a bedding for rails, gas engines, electrical machinery, and so on. It is claimed to be "durable, resilient, and waterproof." A non-inflammable roofing and flooring felt is also supplied.

The Union Electric Co., Ltd., London.—New list (No. 4,001) of automatic circuit breakers, including both direct and alternating current apparatus of types suitable for ordinary motor installations, and for the heaviest duties imposed by traction work. They are supplied up to 650 volts and 2,500 amperes for mounting independently, and on front of or behind switchboard. Particulars are given of cell regulators, including an automatic double regulator for large installations, and such installations as have to run with a minimum of attention.

Messrs. Balcke & Co., 27, Clement's Lane, E.C.—Illustrated list of Balcke's patent cooling towers as employed at a large number of electricity works in different parts of the kingdom. A list of such works is given.

The Rhodes Electrical Manufacturing Co., Ltd.—Sunbridge Road, Bradford.—New catalogue, well illustrated, dealing with direct and alternating current motors and dynamos. A specification and a large number of tabulated data are given, with full particulars as to prices. The R.E. type back-geared motors, and semi-enclosed dynamos; the R.X., R.S. and R.H. semi-enclosed alternating motors are all included.

Messrs. Chas. Davies & Co., 19, New Brown Street, Manchester.—List describing Evenden's patent silent built gear, which is claimed to "run like raw hide and wear like steel, to be strong and noiseless, and to be unaffected by oil or moisture." It is made of hard vulcanised fibre with alternate plates of sheet-steel. Where two built wheels work together, the laminations of steel and fibre are so arranged that the steel of one wheel works only on the fibre of the fellow wheel; both wheels are thus rendered elastic, and vibration is reduced to a minimum.

Messrs. Ward & Goldstone, Dutton Street, Strangeways, Manchester.—New supplement of electrical supplies. Considerable reductions in prices are here announced, and contractors should write for a copy of the list.

Refuse Destructors.—The Horsfall Destructor Co., Ltd., of Leeds and London, have been awarded a "Diplôma d'Honneur" in Class 3 (Hygiene) at the Liége Exhibition for their exhibit of refuse destructor plant.

Milan International Exhibition, 1906.—A good deal of information has already appeared in our columns relating to the electrical arrangements at this Exhibition. A letter is now being circulated among the electrical trade signed by Mr. Chas. P. Sparks, the chairman of the Electrical Trade Section of the London Chamber of Commerce, in which he invites attention to the special opportunities offered to all those interested in electrical matters in this country by the Exhibition, and expresses a hope that members of the trade will personally interest themselves therein with a view to ensuring that a representative show of the varied products of British electrical industries worthy of their growing manufacturing importance and international standing may be made. As we have already said, detailed information regarding the Exhibition may be obtained on application at the offices of the British Commission, at Oxford Court, Cannon Street, E.C. The Hon. Executive Commissioner informs us that the increased demand on the part of Italian and foreign competitors for space at the Exhibition has obliged the authorities to acquire an additional site of about 500,000 sq. ft.; this is situated on the Via Buonaroti, not far from the Piazzi d'Armi, the smaller of the two Exhibition sites. On this extension will be erected the pavilions for the Aerostatic exhibit, together with spacious tribunes from which the public will view the evolutions of dirigible and other balloons. The pavilion for metrological exhibits will also be in this annex. The additional space thus rendered available on the Pazzi d'Armi will be utilised for extensions of the galleries for sea and river transportation and for the very important exhibits of Italians resident abroad.

Electro-Deposited Copper.—On Wednesday last a demonstraton was given of his process for the rapid electro-deposition of copper, by Mr. Sherard Cowper-Coles. This process, which is the outcome of about seven years' experimental work, is intended to supersede other methods in the production of copper tubes, copper wire, and sheet copper. It has already been described in the Electrical Review.

Brush Contracts.—The following contracts have been booked by the Brush Electrical Engineering Co.:—

For the Buenos Ayres and Pacific Railway Co.—Three 250-kw. turbo-alternators with condensers and pipework.

For a Spinning Mill, Oporto.—400-b.h.p. turbo-alternator, 43 motors and accessories for complete electric lighting and power installation.

Improved Ladder Tower.—As it frequently happens that a district has lamps direct above the column, as well as swan-neck lamps, and lamps hung from trolley wire brackets, Mr. Heathman, of Parson's Green, London, has made an improved telescopic ladder-tower, which suits all three kinds of lamp fixings, and is controllable by one man. It is also arranged for use on unlevel and sloping roads, as a very simple provision is made to raise the ladder plumb while the carriage has one wheel down in a gutter. Mr. Heathman has also an arrangement for tower wagons to be set upright when the wagon stands either end downhill, and this is an advantage in very hilly districts. Further, he has supplied to Newport (Mon.) Electricity Works a wheeled ladder arranged so that the man walks through the ladder on to a platform and stands behind the ladder to reach arc lamps suspended from the bracket arms.

Trade Announcements.—Messrs. A. W. Pocklington and Co., of 109, Victoria Street, Westminster, S.W., have been appointed sole agents in London and district for the Anchor Cable Co., Ltd. They keep a stock of all the most usual sizes of rubber-covered wire.

Messrs. Orenstein & Koppel, of Bush Lane House, Cannon Street, London, E.C., have amalgamated with Messrs. Arthur Koppel. In future the combined business of the two firms in the United Kingdom will be carried on by Messrs. Arthur Koppel at 27, Clement's Lane, Lombard Street, E.C. There will be no change in the policy the two firms have hitherto pursued, and the staff of both firms has been retained. Standard types and sizes of all plant previously supplied by either firm, as well as spare parts and fittings for renewals or repairs, will be stocked for immediate delivery. The total combined paid-up capital of the two firms is £1,100,000.

Mr. R. Salem, of 71, Bishopsgate Street Within, E.C., has been appointed sole representative for London and the South and South-East of England, for Mr. William Sanders, Electrical Works, Ridding Lane, Wednesbury.

Russia.—An imperial order has just been issued authorising, for a period of five years, the importation, free of duty, of all kinds of electric lighting apparatus ordered from abroad by the Minister of the Marine for lighthouses.

Smoke Nuisance.—The Underground Electric Railway Co., Ltd., was fined £10 and costs by the Kensington divisional magistrates on Tuesday for permitting dense black smoke to issue from the generating station chimneys in Lot's Road. The Chelsea Borough Council pressed for a prohibition order, but the company said this might compel a stoppage of the electric trains. The company was doing all it possibly could to mitigate the smoke nuisance. The Chairman said the Bench did not desire to inconvenience the public, and would only grant an abatement order.

LIGHTING AND POWER NOTES.

Australia.—Subiaco (W.A.).—Owing to the rapidly increasing consumption of electricity among the residents of this suburb (some 3 miles from Perth) the Municipal Council has decided to extend its E.L. plant. The tender of Messrs. W. H. Kidstone & Co., of Perth, has been accepted for the supply of two 76-h.p. B. & W. boilers, and a feed-pump, one 92-kw. and two 46-kw. E.C.C. dynamos, Belliss engine, balancer, switchboard, crane and overhead mains, at a cost of about £4,000

Barking.—The accountant and electrical engineer have been requested to report to the Council in committee as to the extent to which the electrical undertaking is dependent upon public lighting for its success, and whether any material saving can be secured by extinguishing a large number of street lamps at midnight.

Beaconsfield.—The Uxbridge and District Electric Supply Co. has asked the U.D.C. to consent to an application for a prov. order for E.L., the main object being to supply Penn and Seer Green, for which consent has been given by Amersham Council, and which places the company cannot reach unless it comes through Beaconsfield. The latter Council last June refused a similar request, but has agreed to consider the matter further.

Bettws-y-Coed.—The T.C. has drawn up a draft agreement between it and the E.L. syndicate, which provides that the syndicate must pay the prov. order expenses; that the light must be available within 18 months, otherwise the order reverts to the Council free of cost; the maximum charge for public and private lighting to be 6d. per unit; all mains to be underground; and distribution not to be at a higher pressure than 220 volts.

Brechin.—Under the auspices of the North of Scotland E.L. and P. Co. an electrical exhibition has recently been held in the town.

Brynmawr (Brecon).—It has been agreed to call a conference of the local authorities to discuss the steps to be taken for the proposed lighting of the mineral section of Breconshire by electricity.

Carlisle.—The Corporation Electricity Committee reports that the past year's working of the electricity undertaking, shows an actual loss of about £400, excluding the amounts due for interest and sinking fund instalments upon the increased capital account.

Continental Notes.—Italy.—The Bergamo prefectural authorities have granted a concession for a plant to be put down to utilise the water-power of the River Cherio at Molino di Colognola, to be used for power and lighting purposes in the Gardoni Weaving and Spinning Mills at that place.

The Italian engineers attach considerable importance to published commercial results giving the working costs of electric generating stations in England. The paper read before the Municipal Electrical Association at Edinburgh by Mr. Sinclair, the chairman of the Swansea Electric Lighting Committee, was given in full in the Milan *Electricity* for October 13th.

Spain.—The Spanish Oerlikon Co. has secured a contract from the Sociedad Hidro-Electrica del Guadiaro for the establishment of an electricity works in the Seville district. The water-power of the Corchado Falls is to be utilised, and the energy generated will be transmitted a distance of 75 miles at a pressure of 50,000 volts.

Germany.—An electricity works is to be established at Miechowitz, Silesia.

France.—La Compagnie Générale Electrique is preparing a scheme for the installation of an electric power station in the Horme Valley, with the object of supplying energy for lighting and power purposes in the district between Conflans-Jarny and Homecourt.

Chelmsford.—A contest between gas and electricity has arisen in Chelmsford. The contract of the Chelmsford E.L. Co. for lighting the public streets expires in March next, and the T.C. recently advertised for tenders for lighting the public streets by "electricity, gas, or other illuminant." It received two tenders. The E.L. Co. offered to light the public street lamps at £25 5s. a year for each arc lamp, and £3 3s. for each incandescent lamp, the total cost being about £1,450 per annum. The Gas Co. offered to erect lamp columns and fix lanterns with enamel reflectors, and lay the necessary service pipes to 281 single burner lamps of 75 c.p. each, 20 three-burner lamps of 300 c.p., and 10 two-burner lamps of 200 c.p., for £1,150 per annum. The E.L. Co. proposed that the 21 arc lamps should each be of 1,000 c.p., but if the Council preferred to have flame lamps, each lamp would be increased to 2,750 c.p., the cost remaining the same. With regard to the 281 incandescent lamps, each of these would, under the new contract, be of 70 c.p., except at the corners of streets, where they would be of 150 c.p. The company also agreed: That the fines for lamps which went out should be doubled; the height of the lamps should be altered; the positions of the lamps should be altered when considered necessary; a recording pressure indicator should be placed in the borough surveyor's office; the overhead wires from Messrs. Wenley & Son's establishment to Wood Street (a mile), and the wires in Upper Mildmay Road (from the junction of Lady Lane to St. John's Road), from Maltese Road to Park Avenue and up Park Avenue, should be placed underground. All the alterations are to be made before Christmas. The total c.p. under the old contract was 29,992, and under the new contract, if the "flame" arcs are used, 79,020 c.p. The Committee has agreed to recommend the Council to accept the tender of the E.L. Co. for five years, the Council to have the option of determining it at the end of three years by giving six months' notice.

Crediton.—The local Gas Co. has informed the U.D.C. that it believes there is room for a supply of electricity to the district, and that it is prepared to meet the demand that already exists for such a supply, if the proposal commends itself to the Council. The T.C. has resolved to consider the subject in private.

Cumberland—The C.C. has received from the L.G.B. permission to borrow £5,300 to defray the cost of the electrical installation at Garlands Asylum, "on condition that no part of the loan will be expended on incandescent and Nernst lamps."

Dunfermline.—It has been decided to apply for a prov. order for electric lighting in the town; the question of adopting suction gas plant for generating purposes will be considered. Negotiations with the Fife Electric Power Co. are also proceeding.

Ealing.—The T.C. has resolved to adopt a sliding scale for consumers taking energy for power and heat, the rates to be 2½d. per unit for the first 3,000 units per annum, 2d. per unit for the next 3,000 units, and 1½d. per unit for all over that quantity.

Easthampstead.—A committee was recently appointed to interview the Camberley Electric Supply Co. with reference to its proposed application for a prov. order for the district. The Mutual Electrical Supply Co. is also considering the question of electric light supply in the area.

Exeter.—With the object of affording the local public an opportunity of gaining some knowledge of the variety of uses to which electrical energy is now put, the City Council has organised an electrical exhibition in the Victoria Hall—the largest public building in the city—which was opened by the Mayor on Tuesday afternoon last. The exhibits were tastefully and effectively arranged under the superintendence of the city electrical engineer. Electric fittings by the General Electric Co. and Messrs. Falk, Stadlemann & Co., and photographic arc lamps, by the Westminster Engineering Co., attracted much attention. In the centre of the hall a good display is made by Mr. A. J. Booking, of Exeter; whilst Mr. W. H. Rippon, another local electrician, is exhibiting the "Excello" arc lamps. The latest appliances for electric baths, the X-ray, and high-frequency apparatus, are on view. An extensive show of electric motors is made by Messrs. Wippell Bros. & Row, Exeter. The exhibition is to remain open five days.

Felixstowe.—The Lighting Committee reported recently that, under the agreement with the Suffolk Electricity Supply Co. £3,000, part of the purchase money, was not to be due to the company until the net revenue from the preceding 12 months amounted to a sum sufficient to pay 6 per cent. on the capital at the commencement of such 12 months. The company had given notice that on November 11th the £3,000 would become due. The Committee recommended that the L.G.B. be applied to, to sanction a loan of £3,000 to pay the company, but this has been referred back.

Greenock.—The Corporation has decided to increase its borrowing powers by £50,000, of which £25,000 is required immediately for the extension of the works and plant. The remainder will be required for a new refuse destructor.

Haslingden.—The Council is to make arrangements with the Lancashire Electric Power Co. for the supply of electricity to the town.

Horsham.—A new 220-H.P. set was started up at the U.D.C. electricity works on the 2nd inst.

India.—Lucknow.—Improvements are being made to the Government House in connection with the forthcoming visit of the Prince and Princess of Wales, the principal item being an installation of electric light, which is being carried out by Messrs. Balmer, Lawrie & Co., of Calcutta, at a cost of nearly Rs. 30,000.

Lancashire Cotton Mills.—A Press representative says that following upon the starting of the electrically-driven Acme spinning mill at Pendlebury and the announcement that the Kearsley Spinning Co.'s new mill at Prestolee is to have electricity as the motive power, it is understood that another mill at Farnworth is arranging for a supply of electricity, and a mill to be built at Swinton is to be electrically worked.

Leyton.—The U.D.C. has decided to give consumers the option of a flat rate of 4½d. per unit.

Liverpool.—The T.C. has decided to apply to the L.G.B. for power to borrow £9,000 for electrical purposes.

Llangollen.—The U.D.C., after carrying out experiments and visiting various towns, has decided to adopt electricity for the entire lighting of the town. Energy will be supplied by the local E.L. company. Compared with the cost of gas, electricity is to save per annum a sum equal to a rate of 1d. in the £.

London.—Bulk Supply.—As might be expected, the Hackney B.C. Electricity Committee has decided again to oppose the Administrative Bill next session, if it be re-introduced. The Committee desires wider powers for the development of its undertaking, which should embrace the right to connect up its works with the works of any of the local authorities whose area adjoins Hackney, for the purpose of giving or taking a supply of electrical energy in bulk. It is pointed out that Bethnal Green is now negotiating for a bulk supply from one of its adjoining authorities. The Hackney B.C. also desires to secure powers to supply energy to premises situated partly within and partly without its area to avoid a consumer having to take a supply from two sources. A municipal system of letting out on hire and supplying motors, wires, and fittings is also advocated by the Committee, the contention being that this would materially assist the profitable development of the undertaking, and also be advantageous to the small power users. The Committee, in regard to this question, states that there is a general feeling that the House of Lords would not be inclined to grant powers for the hiring out and supplying of fittings, &c., to many authorities through the agency of the L.C.C., but that if any council required these powers, application would be more likely to meet with success if applied for individually. The Committee recommends that the "standby clause" be obtained.

In a further report, the Committee states that the clerk and engineers had been in conference with the officers of the following districts: Bethnal Green, Islington, Leyton, Poplar, Shoreditch, Walthamstow, and West Ham on the question of placing the various E.L. undertakings in a position to defy the threatened competition by the Administrative Co., on the advisability of generating electricity on a large scale, and to endeavour to arrive at an agreement for supplying energy in bulk. The various districts will probably support the proposals put forward by the Hackney B.C., and, in view of the "mutual benefits to each district," the Committee states that it is intended that *pro rata* contributions shall be made towards the cost of the necessary application to Parliament.

The Finance Committee of the Stepney B.C. reported on Monday that the matter of the various power supply Bills had been under consideration by the E.L. Committee, and negotiations had been entered into with neighbouring boroughs on the matter. At a conference held some days ago at the Great Eastern Hotel, the following authorities were represented:—Bermondsey, Hackney, Islington, Poplar, Shoreditch, Stepney, Woolwich, East Ham, West Ham, Ilford and Leyton. The following resolutions were passed:—(*a*) That this conference agrees to united action with regard to legislation for enabling municipalities to give a bulk supply of

electricity at their boundaries or outside their areas, either by combining to establish a joint bulk station or stations, or by linking up the existing sources of supply, or by both methods; (*b*) That this conference appoints an executive committee to take the necessary steps to carry out the above resolution, to consist of one representative of each authority with power to add to their number, and to form sub-committees; and (*c*) That the councils represented at this conference petition the Government and the B. of T. to reintroduce and carry in the coming session, the Supply of Electricity Bill as introduced in last session. The Finance Committee has pointed out that in connection with this suggested joint scheme, it would be hazardous to promote one Bill, as if one borough should reject the scheme, it would fall through. This Committee recommends that steps be taken with a view to the promotion of separate Bills in the next session applicable to the respective boroughs. The lines upon which the respective councils' notices should be given, are those approved by the executive committee of the conference, viz., that each Bill should contain provisions (1) enabling each borough to give a bulk supply, either by itself or in combination with any other borough having similar powers, to any authorised distributor for distribution within the area of that authorised distributor. (2) Enabling each borough to take a bulk supply from any undertaker or combination of undertakers authorised to give such bulk supply for distribution within the area of supply of such borough. (3) Enabling each borough to provide a station or stations for the purpose of such bulk supply within its own area, either alone or in combination with other boroughs. (4) Enabling each borough to contribute to the cost of the erection of a station or stations, and the laying of the necessary trunk mains, and the provision of other apparatus in connection with such bulk supply, which may be provided within the area of another borough, either by that borough alone, or by that borough in conjunction with other boroughs, for the purpose of such bulk supply. (5) Enabling each borough, for the purpose of giving effect to the foregoing provision, to lay trunk mains through the area of any borough intervening between the areas of supply to be connected by such mains. (6) Protecting consumers by providing that in the event of any borough or boroughs taking a bulk supply, the maximum price to be charged by such borough for power purposes shall not exceed £4 per kilowatt per annum, and ½d. per unit." The Stepney E.L. Committee in a report circulated also on Monday stated that it had decided (subject to the usual sanction) that any consumer whose total accounts for the half-year ending June 30th and December 31st reached £60 or over, or who was willing to guarantee this amount as a minimum payment for each such period, the charge for energy for lighting purposes should be 6d. per unit, instead of 8d., as at present, for the first 3 hours of the maximum demand during each of the six months ending March, and for the first 20 hours' use during each of the six months ending September, and 9d. per unit instead of 1d. per unit, as at present, for all further consumption in each month. The public lighting account would automatically come within the terms of this proposal, which would reduce such account annually by about £1,000. It is intended that in calculating the total amount of a consumer's half-yearly bill for the purpose of arriving at the minimum mentioned, the accounts for lighting, power and other purposes on the same or different premises should be added together, provided that, in the accounts of different premises so added together, the average half-yearly account per service shall not be less than £15.

In a special report, Mr. Arthur Wright, the consulting electrical engineer, and Mr. W. C. P. Tapper, reply to statements made in a London daily paper in August last, with reference to the compromise effected by the Council with the promoters of the Administrative Co., and contend that, had the company's Bill gone through, Stepney, by the arrangement entered into, provided it ran Osborne Street station at its full capacity, would make an annual saving of £3,289, while, had the company obtained the Bill with competing powers in Stepney, as originally proposed, there was no doubt but that a loss would have been made which must have eventually ended in financial disaster for the undertaking.

L.C.C.—At the meeting on Tuesday, it was decided to lend £13,700 to the Hammersmith B.C., repayable in 10 years, for boilers and fittings and steam piping, and £991 to the Woolwich B.C. for electrical works.

The adjourned report of the Finance Committee was brought forward, recommending the advance of £25,000 to the Fulham B.C. as part of a larger loan for E.L. purposes. In a further report, the Committee stated that the plant already installed at Fulham was only sufficient to supply the estimated maximum demand during the coming winter, and that it therefore appeared necessary for an immediate addition to be made. Under the circumstances, the Committee did not think the Council should refuse to sanction the proposed loan. It was stated that an Act was passed in the last session which authorised the Metropolitan Electric Supply Co. to supply in bulk and the company could connect it mains with those of Fulham for the purpose. In all probability Fulham could obtain a supply in bulk, from that company cheaper than it could generate on its own account. Col. Rotton moved an amendment, which was seconded by Sir Henry Bliss, proposing to refer back to the Committee the recommendation made in favour of the granting of the loan. A representative of Fulham remarked that although that district was included in the Metropolitan Co.'s Bill, it was excluded from the company's Act. The sum of £25,000 in question had already been expended, but the Borough Council was ready to consent to any recommendation which the County Council might make in regard to the remainder (£42,000) of the loan. Dr. Napier observed that, as far as his recollection went, Fulham was retained in the company's Act. Perhaps the chairman of the Committee would throw light on the question.

The C.C. was asked if it wished to paralyse the E.L. work of the Borough Councils. The latter were not compelled to approach the County Council in regard to loans; it was only a technical matter. After further discussion, Lord Welby, in reply, stated that the Finance Committee did not have before it the company's Act when discussing the proposed loan to Fulham. In arriving at a decision on the question, the Committee was very much influenced by the fact that the application for a loan was received just as the County Council rose for the vacation, and the matter could therefore, not then receive consideration. There was, consequently, a delay, the scheme was divided into three sections, and the £25,000 had already been expended, and in the circumstances the Committee did not feel justified in refusing the loan. The amendment, which was then put, received 23 votes, the majority of the Council being against it. It was, therefore, defeated, and the recommendation of the Committee was then agreed to.

Marylebone.—In regard to the work in connection with the change of pressure of supply, 2,000 installations had been changed over by the 31st ult.

Bermondsey.—The E.L. Committee submitted to the B.C. correspondence which had passed between it and Electric Lighting Companies. The County of London Electric Supply Co. wrote offering to deal with the undertaking on the following alternative bases:—(1) To supply the Council with energy in bulk at a price cheaper than the Council could generate same. (2) To take over the undertaking on lease and work same, the company guaranteeing the Council a sum sufficient to provide sinking fund and depreciation on the capital expended. An interview was asked for to discuss the matter. In reply, the Committee wrote: "As your company have no power to supply in the district over which the B.C. supply, and the B.C. no power to supply in a portion of your district within this borough, the Committee fail to see that any benefit would would accrue from an interview with you." Mr. R. Stewart Bain, managing director London Electric Supply Corporation, Ltd., has written in regard to the proposal to increase the B.C. plant, stating that if a meeting took place between the engineers of the Council and his Corporation, the latter might be able to make a suggestion which would obviate any further capital outlay by the Council in connection with its installation and put an end to the cutting of rates between the Council and the Supply Corporation. In reply, the Electric Lighting Committee stated that there would not be any advantage gained by such a meeting. Further, "the Committee is by no means wishful to place in the hands of a monopoly the opportunity of increasing the charges to consumers of electricity, this being, as the Committee understand, the suggestion contained in your letter which speaks of putting an end to the cutting of rates between this Council and your corporation. The Committee is not aware that in any sense has a cutting policy been adopted by it, its only desire being to supply the public with current for light and power at a reasonable and fair charge." As the correspondence was merely submitted without a recommendation, the Chairman of the Committee did not propose any motion. The electrical engineer has been instructed to bring up an estimate for condensing plant.

On the 7th inst. the B.C. resolved *nem. con.* to take the necessary steps for promoting jointly with the other municipal authorities interested legislation for the giving of a bulk supply.

Islington.—The B.C. has been asked by the L.C.C. to appoint two representatives to a conference *re* electricity supply in bulk, to be held at Spring Gardens on 20th inst. In regard to the conference held at the Great Eastern Hotel, the B.C. has informed the secretary that, though not prepared to introduce a Bill for Islington, the Council would support any action which was taken by the L.C.C. or by any metropolitan B.C. to enable municipalities to give a bulk supply of electricity.

Woolwich.—The Electricity Committee has reported that the parish of Eltham is now receiving a supply of electricity direct from the Plumstead station, and that the agreement with the Electric Supply Co. for the supply of electricity in bulk at 4d. per unit has been determined. It was resolved that the scale of charges for electric supply in Eltham be made uniform with the scale at present in force in Woolwich and Plumstead, and that meter rents be abolished.

Battersea.—The Lighting Committee reported on Tuesday last that on the year's working of the E.L. undertaking, and after deducting all expenses, a profit of £295 had been made. The repayment of loans, which were suspended for three years, began during the year under review, thereby increasing the payments by £3,500. In connection with the accounts, the Committee has received a communication from the L.C.C. suggesting the establishment of a reserve or renewal fund. The Committee resolved to reply "that while they were in favour of the views expressed in the L.C.C.'s letter, they did not see their way to carry out the wishes of the C.C. at this stage." The net profit is to be carried forward to the next year. Under the existing scale of charges, if any quarter's account for energy is less than 15s., charges are made for meter rates varying from 3s. to 3s. 9d. per quarter. The amount received for meter rents during the past year was £63, as against the total receipts of £23,698. Having regard to the disproportion in these receipts, the Committee has decided to abolish the charges for meter rents, after the Michaelmas quarter readings. In regard to the accumulation of mud which occurs in the pipes in connection with the condensing plant, the electrical engineer has prepared a scheme, providing for the discharge of water from the pumps down the pipes from time to time to clear the mud.

Hammersmith.—The report of the past year's working, ended March last, of the B.C. electricity undertaking, states that the expenditure was less than that for the previous 12 months, but that the revenue had increased by about £3,000. The net profit amounts to £5,282.

City.—The chairman of the Streets Committee was asked last week if the Committee would consent to the withdrawal of the notices recently served on the City of London Electric Lighting Co. requiring them to remove their lamps and standards in various important streets of the City, pending the result of the present experiment in incandescent gas lighting, as either proving or disproving the contention that such lighting was more efficient and satisfactory than the electric light. The chairman replied that the three months' notices to remove the electric lamps were served on the company some time ago. Since then the company had appealed to the Corporation to cancel the notices, but it had declined. The Committee would report carefully and impartially on the experiment now being made, and the Corporation could take any action it liked in the matter.

Cuckfield.—The U.D.C. has decided not to assent to the application of the Hayward's Heath and District Electric Supply Co. for a prov. order for E.L.

Liversedge.—The U.D.C. has decided to call in one of the engineers of the Yorkshire Electric Power Co. to advise it on the question of laying mains in a part of the district scheduled under an agreement with the company.

Mynyddislwyn.—The U.D.C. has decided to consent to a prov. order for E.L. being applied for by a local company, on condition that the Council shall have the option to purchase the undertaking at the end of 7, 14, 21 or 28 years on terms to be arranged. Terms for public lighting are also to be approved of by the Council.

Ramsgate.—A trade and electrical exhibition was opened at the Royal Victoria Pavilion by the Mayor on Tuesday last.

Redcar.—The U.D.C. on November 2nd approved of an agreement with the Cleveland and South Durham Electric Power Co. for electric lighting.

Rhymney Valley.—The U.D.C. of St. Mellons has appointed a committee to meet the promoters of a scheme for electrically lighting the Rhymney Valley in the area of its district.

South Africa.—Cape Town.—The electric power installation for driving machinery at the naval dockyard at Simon's Town is now nearly complete. As soon as the new motive power is in working order, a number of steam engines, at present used for running fans, forges, and machine tools of all descriptions, will be discarded.

King William's Town.—A correspondent writing on the 13th ult., states that owing to the recent exceptionally stormy weather in Cape Colony, the E.L. station has been under water, and several days must elapse before the electric light is available. The work of clearing the station is proceeding night and day.

East London.—From the *East London Daily Dispatch* we learn that on the working of the borough electricity undertaking there is a net loss of £589 for the year 1904-5. At the last meeting an outlay of £1,800 was sanctioned for surface condensers at the power station, and it is urgently necessary to expend £17,550 on additions and alterations. For the year ending February, 1905, the receipts were £32,756, of which £17,364 was obtained from electric lighting and £15,391 from the tramways.

Southwick.—The U.D.C. has resolved to make application to the L.G.B. for a prov. order authorising the Council to supply electricity for public and private purposes throughout the district, but that such application be only proceeded with providing the Urban Councils of Portslade and New Shoreham also proceed with their proposed applications for similar purposes. The clerk explained that negotiations were proceeding with the Brighton Corporation as to whether the terms offered 18 months ago could not be modified.

Stockton-on-Tees.—The Cleveland and South Durham County Electric Power Co. has applied to the T.C. for permission to supply consumers within the Council's area, and a committee has been appointed to arrange terms with the company.

Stourbridge.—The U.D.C. has requested the Electric Power Committee to lay before the Council an E.L. scheme, and also to ask the company which had obtained certain electrical powers, what favourable terms they were prepared to give the Council before other steps were taken.

Swanage.—The U.D.C. has decided to approve of an E.L scheme promoted by the Bournemouth and District Electricity Supply Co., Ltd. The Council is to have the option of purchasing the undertaking at the end of 21, 28, 35 or 42 years, and the maximum charge for energy is to be 7d. per unit for lighting, and 2½d. per power.

Thornaby-on-Tees.—The T.C. has decided to apply to the B. of T. for the transfer of its 1902 E.L. order to the Cleveland and Durham County Electric Power Co., Ltd.

Tonbridge.—The U.D.C. on November 1st decided to apply to the L.G.B. for a loan of £2,000 for E.L. purposes.

Wishaw.—The electric light, which has just been introduced into the town, was formally inaugurated on the 3rd inst. in the new Burgh Court Hall. The cost of the scheme to the burgh is about £10,000. The price charged to consumers is 3½d. per unit. Energy is supplied by the Clyde Valley Co., and is transmitted from their new power station at Motherwell.

Worcester.—The City Council has decided upon the adoption of electricity instead of gas for driving part of the pumping plant at Bromwich at a cost of £920. The price to be charged is ¾d. per unit.

TRAMWAY AND RAILWAY NOTES.

Belfast.—According to the return compiled by the City Accountant, the total sum paid on account of the tramway system up to the 16th of last month was £767,564. Against this £9,408 had been received for a portion of the old rails, leaving the net sum expended £758,156. Since that date further sums amounting to £60,000 have been paid. The work is now rapidly nearing completion, though it is doubtful whether the electric traction will be fully in operation on the 14th inst., which is to be the opening date of the extended time given to the contractors.

Blackburn.—A statement prepared by the borough treasurer shows that for the six months ending September 30th, the net profits of the tramways undertakings of Blackburn amount, in round figures, to £1,434. The income was £28,621, equal to an average of 13·36d. per car-mile. The traffic receipts amounted to £27,668, or 12·92d. per car-mile. The expenditure account showed traffic expenses, £5,866; general expenses, £1,508; general repairs and maintenance, £3,505; and power expenses, £5,670; making a total of £16,550, or 7·73d. per car-mile, thus leaving a gross balance of £12,072. The requirement in respect of loans (interest and sinking fund), £10,638, reduced the available balance to £1,434.

Continental Notes.—Spain.—A concession has just been granted for the construction and working of an electric tramway between Pamplona, Aviz and Sanguesa.

Russia.—A company has just been formed in Brussels, with a capital of £400,000, to be known as La Compagnie Belge pour les Tramways et Eclairage Electrique de Saratoff to establish and work a system of electric tramways and a central electric lighting station in the town of Saratoff.

Italy.—A petition has been presented to the Minister of Public Works for permission to construct an electric railway from Rome to the sea, a length of about 21 km. The plans have been prepared by Engineer V. Bocca.

Croydon.—On Thursday last week the B. of T. inspection of a short but very important length of line at South Norwood took place. It is an extension of the present Croydon system as far as the borough boundary, where it joins the Penge system now under construction. This portion of 800 yards was laid by the Croydon Corporation, under the supervision of Mr. E. F. Morgan (borough road surveyor), while Mr. Alex. C. Cramb (borough electrical engineer) was responsible for the electrical equipment. Lieut.-Col. Von Donop, after a run over the section, and the usual examination, expressed himself as quite satisfied, and settled the speeds at from four to eight miles per hour; but a remarkable incident characterised the inspection. As we have previously stated, the British Electric Traction Co. has a lease of the present Croydon system which expires in May next, under which November 30th is the last day on which the Croydon Corporation can give notice for the termination. This has already been done as regards the present system, and the same process has to be gone through in regard to this short new length of line if the Corporation is to get a sum of £3,000, which the company has undertaken to hand over on the completion of what we may call the supplementary lease, the same being a contribution towards the cost of certain improvements to bridges. This lease will fall through concurrently with the larger one in May, 1906. Consequently, in the event of the Croydon Corporation deciding to in future work their own trams, as is not unlikely will be the case, the company might have something to gain by any material delay in the opening of the small piece of line above referred to. For the purposes of the inspection a tramcar was necessary, and as the lessees always have some spare ones on hand, there being about 40 on the Croydon service, they were applied to for the loan of a car. It would only have meant running it a few yards beyond the present terminus at South Norwood. The Tramways Committee was given to understand that its request would be acceded to, but on the Monday preceding the inspection it was informed that it had been found necessary to refer the request to the headquarters of the B.E.T. Co., and subsequently it was said that the directors would have to be consulted. Coming to the conclusion that the chances of getting the loan of a car on Thursday were very dubious indeed—in fact, the company's attitude was now looked upon as tantamount to a refusal—Mr. Morgan went to the B. of T. and suggested that the line might be inspected and approved without the use of a car, but the answer of Col. Von Donop was, "You had better get a car somehow; there might be litigation." Under these peculiar circumstances the West Ham Corporation gave ready consent to one of its cars being lent to the Croydon Corporation. Loaded upon a lorry, with the roof fittings dismantled so that it could pass under all the bridges *en route*, and drawn by a traction engine, it arrived at South Norwood at 4 a.m. on the day of the inspection. It was got into full working order in time, and the official inspection came off at the hour fixed. Some very strong criticism has been heard in Croydon over this incident, particularly because of the fact that all the tramway rolling-stock in the borough is Corporation property, the lease to the B.E.T. Co. being solely for working purposes. An unsportsmanlike action of this kind, which is not far removed from sharp

practice, ought to be beneath the consideration of any concern, and will do more to alienate public sympathy than reams of municipal trading screeds.

Elland.—The U.D.C. on November 1st received notification that the National Electric Construction Co., Ltd., intended to promote a Bill for the construction of electric tramways through the town in connection with a scheme joining Halifax with Huddersfield. A resolution was passed expressing general approval of the scheme.

Huddersfield.—The annual statement in regard to the Corporation's tramway undertaking shows that 2,892,991 units of electricity were generated, an increase of 113,726 over last year. The average generation cost per unit is ·246d., as against ·249d., and the average works cost per unit, including maintenance and materials used, is ·273d. as compared with ·271d. last year. The rolling-stock consists of 70 cars. The system of coal haulage has made satisfactory progress, and three firms are now having coal conveyed direct by trucks from the Hillhouse coal shoots into their mills. The total traffic receipts from November 1st, 1904, to September 30th, 1905, amount to £63,223, an increase of £2,421 over the previous year. The number of miles run is 1,542,047, an increase of 19,128, and 12,012,505 passengers have been carried, an increase of 548,472.

India.—Lucknow.—According to *Indian Engineering*, the British Eastern Electric Power Co. has obtained a licence to construct an electric tramway in the Lucknow municipality, with a gauge of 3 ft. 6 in. The maximum speed is not to exceed 8 miles per hour, and the maximum charge, 1 anna per mile. The company receives powers to supply electricity for lighting and power, for public and private use, and is to pay a rental of one-fourth of the net profits in excess of 5 per cent. on the capital outlay to the Municipal Board.

Leith.—The new electric tramway system was formally opened last week by Provost Mackie. Halfpenny fares have been introduced over the whole system.

London.—L.C.C.—The Highways Committee has recommended the Council to apply to Parliament for power to use a number of sites on the north and south of the Thames for the erection of sub-stations and car-sheds, and to apply to the B. of T. to amend the regulations so that trailer cars may be used in connection with the single-deck cars to be employed on the tramway subway from Southampton Row to the Strand.

Tramways Over the Bridges.—The Court of Common Council has agreed to the widening of Blackfriars Bridge, subject to the L.C.C. obtaining powers to run cars over Westminster and Blackfriars Bridges *viâ* the Embankment. The cost of any widening required on the southern approach to the bridge is to be paid for by the County Council, and the latter is to construct and pay the cost of a subway for foot passengers under the roadway at the northern end of Blackfriars Bridge, such subway to belong to and be maintained, lighted and policed by the Corporation. The L.C.C. is also to pay an annual rent for a wayleave over the widened bridge, while the City police have complete jurisdiction and control over the tramway traffic within the City boundary. Cars must not stop on the bridge or within 25 yards of the ends thereof, to set down or pick up passengers, and a space of 60 ft. between cars must be maintained.

The Committee decided to refer the question to Sir Benjamin Baker, who will make a report as to the best method of widening the bridge 40 ft.

Bermondsey.—It was reported at the B.C. meeting on Tuesday that it had been definitely decided by the L.C.C. that the Bill for the electrification of the tram lines through Bermondsey and Deptford to Greenwich and Woolwich would be introduced in the Session of 1907. The B.C. would not be asked to make any contribution to the cost of street widenings, &c.

Metropolitan District Railway.—On Monday the last of the company's steam trains were replaced by electric trains, and now the only remaining steam engines in the tunnels are those hauling the L. and N. W. Railway trains. These will also disappear on December 1st. The electric service has been considerably accelerated in consequence of the change, but a much greater acceleration will become possible next month.

During a thick fog on Tuesday night two electric trains came into collision outside Mill Hill Park Station. Some carriages were damaged, but fortunately there were no fatalities, and no serious injuries.

Merthyr Tydfil.—The Electric Traction Co. has raised an important point in an appeal against the assessment. The company contended that it should be rated strictly upon the receipts and expenditure basis just like gas works and railways, and it was eventually decided, after argument, that the rateable value should in future follow the balance-sheets.

Mexico.—Guadalajara.—The Exports Co. of Galiso (capital 6,000,000 piastres), intends constructing an electric tramway line from Guadalajara to the Port of Chametu.

North Wales.—At a meeting of the North Wales narrow-gauge railway (Moel Tryfan undertaking) last week, a resolution was passed sanctioning a working agreement between the company, the Portmadoc, Beddgelert and South Snowdon Railway, and the North Wales Power and Traction Co., under which the Moel Tryfan undertaking of the company will be worked in perpetuity by the Portmadoc, Beddgelert and South Snowdon Railway Co. It was stated that by the arrangement the company would become an integral part of the through route between Portmadoc and Carnarvon, and they would be able to compete with the motor traffic and be able to do without the assistance of the London and North-Western Railway.

South Lancashire.—A correspondent learns that the Salford Corporation is contemplating continuing its tramway system from Pendlebury to Unity Brook, Kearsley, joining the Farnworth Council trams there. It will then be possible to ride—with half-a-dozen changes, on three or four different makes of cars—from Manchester to Liverpool, and *vice versâ*. This excursion will appeal to people of leisure.

Stourbridge.—The B.E.T. Co. has informed the U.D.C. that it intends to apply to the B. of T. for approval to a transfer of the Kinver light railway undertaking to the Dudley, Stourbridge and District Electric Traction Co.

Swanage.—The U.D.C. has decided to approve of an electric tramway scheme promoted by a private company. The line will connect the town with Bournemouth.

West Ham.—Last Friday the Mayor laid the foundation stone of the new electric tramcar depôt at Greengate Street, Plaistow.

Wolverhampton.—In the annual report to the T.C. of the Tramways Committee, it is stated that the operation of the Lorain system during the last 12 months has been satisfactory in all respects, in spite of the severe atmospheric conditions to which it was subjected during last winter. The maintenance costs still remain at their former low level, and the total working costs of the tramways are said to be considerably below the average of towns where the overhead system is installed. The total revenue has increased by £3,353. The receipts per car-mile, however, show a reduction of a little over 1d. as compared with last year. This is accounted for by the fact that during the past 12 months several routes and extensions have been added, which have not proved so remunerative as some of the first routes opened, but the mileage has increased by 113,813 miles, and the cars have carried during that time 872,702 more passengers.

TELEGRAPH AND TELEPHONE NOTES.

Cardiff.—The Deputy Stipendiary of Cardiff (Mr. E. Milner Jones), who sat as arbitrator in a dispute between the General Post Office and the Cardiff City Council, has given his decision in favour of the Post Office authorities, with costs. The dispute was in respect of the laying of trunk telephone wires along the North Road within the city boundaries. The Post Office authorities desired to remove certain telegraph wires now on the poles, and to place them underground, and to carry overhead additional trunk telephone wires between Cardiff and Pontypridd. Mr. Harpur, the city engineer, stated that the Council would not object to all wires being laid underground, but was averse to there being a number of wires above and others underground.

Congo Free State.—The Bureau International at Berne officially announces the conclusion of an agreement between the State of Congo and the French Government on behalf of their Congo possessions, for the establishment of telegraphic connections and fixing the rates, and how they are to be divided between them.

A new river cable has been laid in the Stanley Pool, connecting Kinchassa and Brazzaville, and the following offices of the Congo State are open for public service, viz., Boma, Matadi, Thysville, Leopoldville, Kwamouth, Lukolela, Irebu, Coquilhatville and Luki.

East Indian Cables.—The Dutch East India Office announces that restrictions on telegrams for and from Sabang, Kotaradja and Olehleh (imposed on February 16th, 1904, by reason of the Russo-Japanese War) are now withdrawn.

Milan and Venice.—The Chambers of Commerce of the respective cities have for some time past been engaged in negotiations to obtain a trunk telephone service; this is now arranged, and the Government will complete the line under guarantees to cover the working costs, by the City of Milan ⅔ths, and by the City of Venice ⅓ths.

Telephone Cable.—Permission was granted by the Thames Conservators on Monday to the National Telephone Co. to lay, subject to protective conditions, an armoured cable under Barking Creek, and two wires over the river at Weltje Road, Hammersmith.

Submarine Signalling.—The Elbe Lightship No. 1 was fitted in September with an apparatus for submarine sound signalling. Trials have also been made with these signals, says the *Morning Post*, on board the German steamer *Deutschland*, from which the bell at the Outer Weser Lightship was located at a distance of five nautical miles, while the noise made by the propeller of a large passing steamer was distinctly heard at a distance of 1½ miles, though the *Deutschland* was steaming 19 knots. The system should be of great assistance to navigation in foggy weather.

Venezuela.—According to the *Morning Post*, the French Government are hopeful that the American Minister will eventually induce President Castro to listen to reason. Should this expectation be unfulfilled, France will take other steps in concert

with the United States. On October 30th President Castro stopped cypher dispatches from the British and American Ministers and the French Chargé d'Affaires to their respective Governments, and they were held back 30 hours and then allowed to be telegraphed, the excuse for holding them being that no answer had been received to a communication from one of President Castro's Ministers to the principal official of the Cable Co., and that in the meantime the Government could not allow any message to leave the country. Formal protests have been lodged by the Ministers concerned. In a note since to the French Legation the Venezuelan Government declares that it will proceed with the cancelling of the French Cable Co.'s concession unless France withdraws her last note and the company undertakes to make satisfactory arrangements within eight weeks. The *Morning Post* Paris correspondent is, however, assured that the French Government would retaliate. President Castro then proposed to France to re-establish relations with M. Taigny if the demand for an apology is withdrawn, and to adjust the cable case by agreeing to return the concession to the French company if they will agree to certain things.

Telegraphic Interruptions and Repairs:—

Cables.	Interrupted.	Repaired.
Trinidad-Demerara (No. 2.)	Aug. 26, 1901	..
Dominica-Martinique	May 7, 1902	..
St. Lucia-Martinique	May 7, 1902	..
Cayenne-Pinheiro	Aug. 18, 1902	..
Reissa-Issa (Yemen) Camaran	Oct. 22, 1902	..
Tarifa-Tangier	Jan. 18, 1904	..
Closed { Vladivostock-Nagasaki	Feb. 9, 1904	..
Closed { Port Arthur-Chifu	Mar. 9, 1904	..
Jamaica-Colon	Jan. 5, 1905	..
Cadiz-Tenerif	July 20, 1905	..
Cotonon-Grand Bassam	Oct. 4, 1905	..
Medan-Olehleh	Oct. 26, 1905	..
Oran-Tangier-Cadiz	Oct. 30, 1905	..
Puerto Plata-Martinique	Oct. 30, 1905	..
Falmouth-Bilbao	Oct. 31, 1905	..
Landlines.		
Puerto-Barrios	July 28, 1902	..
Kertch-Soutehoum	Sept. 27, 1904	..
Communication with Brazil *via* Galveston	July 18, 1905	..
Indo-European lines	Nov. 5, 1905	Nov. 6

Wireless Telegraphy.—During the general strike in Russia, wireless telegraphic communication between Peterhof and Memel, a German town on the Baltic, was established by a German cruiser and two torpedo-boats.

Germany.—The results obtained with the "System Telefunken" having proved that it fulfils the requirements of the imperial post, the official stations between Borkum Riff lightship and the lighthouse at Borkum have been installed. The establishment of a connection between the Borkum lightship and the naval station at Heligoland has also been carried out. A large station for the purpose of controlling the whole of the North Sea is now being installed at Norddeich near Emden, the preliminary work, viz., the foundations for the towers and the erection of the station house, having already so far progressed, that the building of the four iron lattice towers, 60 to 70 metres high, and the putting down of the machines, can be commenced.

Switzerland.—The Swiss War Department is installing two wireless telegraphic stations (System "Telefunken") for the intercommunication of the fortresses of Rigi-Scheidegg and St. Gothard. This department has also purchased from the Gesellschaft für Drahtlose Telegraphie, Berlin, several portable stations, which are regarded as especially suitable for mountainous country.

CONTRACTS OPEN AND CLOSED.

OPEN.

Brazil.—December 16th. The municipal authorities of Sao Luiz (Maranhao), Brazil, are inviting tenders until December 16th for the electric lighting of the town.

Caledonian Railway.—November 16th. The directors invite tenders for stores for twelve months including:—

India-rubber goods, &c.
Asbestos and gutta-percha goods, balata belting, and packings (various).
Telegraph appliances, telephones, &c.
Electric lighting material and fittings.

Specifications from Mr. Jas. Lorimer, Stores Superintendent, Caledonian Railway, Charles Street, St. Rollox, Glasgow.

Cape Town.—November 22nd. Tenders are invited for the supply, to the Department of Posts and Telegraphs, of telegraph and electric light material. Tenders to the Chairman of the Tender Board, Control and Audit Office, Parliament Street, Cape Town. A notice appeared in the Cape of Good Hope Government *Gazette*, for October 3rd.

Cardiff.—November 27th. Battery, booster, engines, generators and switchboard, for the Whitchurch Asylum. See "Official Notices" to-day.

Dublin.—November 27th. Dublin United Tramways Co. (1896), Ltd., want tenders for general stores for one year. See "Official Notices" to-day.

Ebbw Vale.—November 25th. Free wiring and supply of incandescent lamps for the U.D.C. See "Official Notices" to-day.

Leith.—November 11th. The School Board invites offers for an electric light installation at Bonnington Road Public School. Specification, Mr. George Craig, architect, 85, Duke Street, Leith (£1 deposit).

Leyton.—November 16th. Engines with condenser; cooling tower, for the U.D.C. See "Official Notices" Nov. 3rd.

Macroom.—November 10th. The U.D.C. invites tenders for lighting the streets of the town by electricity or acetylene gas.

Rawtenstall.—November 19th. Electric wiring and fittings for the New Free Library. See "Official Notices" to-day.

Spain.—November 27th. The Spanish Ministry of Public Works is inviting tenders until November 27th, for the construction of an electric tramway in Madrid, from the Ronda de Valencia to the Glorieta del Puente de Toledo. Particulars may be obtained from, and tenders are to be sent to, La Direccion General de Obras Publicas, Madrid.

Torquay.—November 20th. One combined 250-kw. d.c. traction and 75-kw. a.c. steam generator set; one 200-kw. motor-generator; reversible booster; battery and switchboard for the T.C. See "Official Notices" to-day.

Turkey.—The Turkish Post and Telegraph authorities in Constantinople are in the market for the supply of 3,000 metres of seven-conductor telegraph cable.

Walthamstow.—November 24th. Stores for the electricity and tramway departments for twelve months. See "Official Notices" November 3rd.

CLOSED.

Bury and Mansfield.—The British Westinghouse Electric & Manufacturing Co., Ltd., have received an order from the Corporation for six tramcars, with complete electrical equipment. The same firm is also supplying six tramcars and electrical equipments for the Mansfield and District Light Railway Co.

Durban, Natal.—The Council has approved of the tender of Mr. C. W. Sully for 200 incandescent street brackets, at 14s. 3d. each (net).

Leyton.—The U.D.C. has accepted the tenders of the Stirling Boiler Co. and the Tudor Accumulator Co., Ltd., for the supply of plant, &c., required for the electric supply to the tramways.

London.—The Highways Committee of the L.C.C. have received the following tenders for the supply and laying of high and low tension cables for the tramways between St. George's Circus and Wandsworth, and for lines at Lewisham, Greenwich, and other places:—

1.—High Tension Cables.

Western Electric Co.	(recommended)	£20,549 16 0
Siemens Bros. & Co.		20,670 16 6
Henley's Telegraph Works Co.		20,719 6 6
British Insulated and Helsby Cables		21,001 16 3
Callender's Cable and Construction Co.		21,396 5 0
W. T. Glover & Co.		21,572 9 7
National Conduit and Cable Co.		21,804 10 0
St. Helens Cable Co.		21,950 10 0
Société d'Exploitation des Cables Electriques	(incomplete tender)	24,664 10 6

2.—Low Tension Cables and Feeder Pillars.

W. T. Glover & Co.	(recommended)	£37,860 0 0
British Insulated and Helsby Cables		38,060 15 10
Henley's Telegraph Works Co.		38,154 13 9
Siemens Bros. & Co.		38,541 0 9
Western Electric Co.		38,628 7 7
Callender's Cable and Construction Co.		39,723 15 0
St. Helens Cable Co.		40,756 10 5
National Conduit and Cable Co.	(incomplete tender)	40,197 0 0
Société d'Exploitation des Cables Electriques	(incomplete tender)	45,169 5 0

The firm of W. T. Glover & Co. proposes to sub-let the manufacture of the cables.

Battersea.—The B.C. has placed an order with Messrs. Cochrane and Son, at £170, for work to get rid of the accumulation of mud in the pipes in connection with the condensing plant; and has accepted the tender of Mr. J. B. Garnham to purchase scrap copper at the central generating station, at £68 5s. per ton; also the tender of Messrs. Oswald & Son to purchase scrap iron, at the rate of 20s. and 38s. per ton.

Bermondsey.—The B.C. accepted on Tuesday the following tenders for the supply of coal to the generating station:—

Mr. Chas. Franklin, "Shipley Peas," 14s. per ton.
Messrs. Hinchliffe & Co., "Bwllfa," 20s. per ton.

The Council has also placed an order, at £86, with Messrs. Crompton & Co. to connect up the reversible booster.

(*Continued on page 770.*)

ELECTRICITY IN THE LONDON HOSPITAL.

The London Hospital, well-known to all who know Whitechapel Road, is the largest hospital supported by voluntary contributions in the United Kingdom. Her Majesty, Queen Alexandra, is the President, and the Hon. Sydney Holland is the chairman of the Governing Board; the secretary is Mr. E. W. Morris. The Hospital maintains nearly 1,000 beds; nevertheless, as it is a free hospital, and serves the needs of an enormous population, its resources are by no means in excess of the demands upon them. The cost of its maintenance is £90,000 a year, for the bulk of which it is dependent upon the generosity of the public. The Hospital has recently been almost entirely rebuilt, at a cost of £400,000, on the most modern and scientific lines.

Interior of the Transforming Station.

The electric lighting and power installation was commenced in 1900, and the work has been going on ever since; the installation is now practically complete, and comprises nearly 6,000 lights and about 100 motors. As this is the largest and most important installation of its kind in this country, a brief account of its leading features may be of interest to our readers.

Finsen Light Apparatus for the Treatment of Lupus.

The whole of the electrical work has been carried out to the designs and specifications and under the supervision of

Mr. H. J. Wagg, of 15, Great George Street, Westminster, who has had unique experience in this class of installation, and is responsible for the design of a large part of the special apparatus and fittings in use throughout the Hospital.

The bulk of the wiring has been carried out by the Alliance Electrical Co., of London and Birmingham; the Out-Patients' Department was wired by Messrs. Strode and Co., of London. Needless to say, the workmanship is everywhere of the highest class. Most of the wiring is in screwed steel tubes or galvanised iron barrel, the latter being used where the tubes are buried in the wall or floor. The new Nurses' Home, which adjoins the Hospital, contains about 700 lights, and has been wired in wood casing, most of the wires being concealed in specially prepared picture mouldings and architraves.

X-ray Apparatus for Radiography.

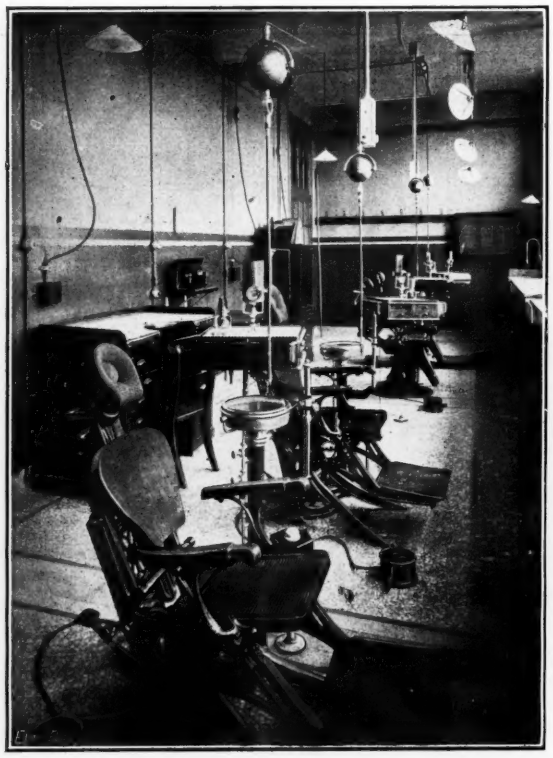
In order to ensure that lamps of the correct candle-power shall be used in every room and ward, they are provided with caps of a different shape for each rating, and the holders are made to correspond therewith. Thus no one but the electrical staff of the Hospital can alter the candle-power available at any point, and they only by changing the holder. This is a very important and necessary precaution.

A number is affixed to each switch, corresponding with a number on the fuseboard with which it is connected, so that in the event of the failure of any light it is an easy matter to identify and examine the fuse controlling the circuit upon which it is run.

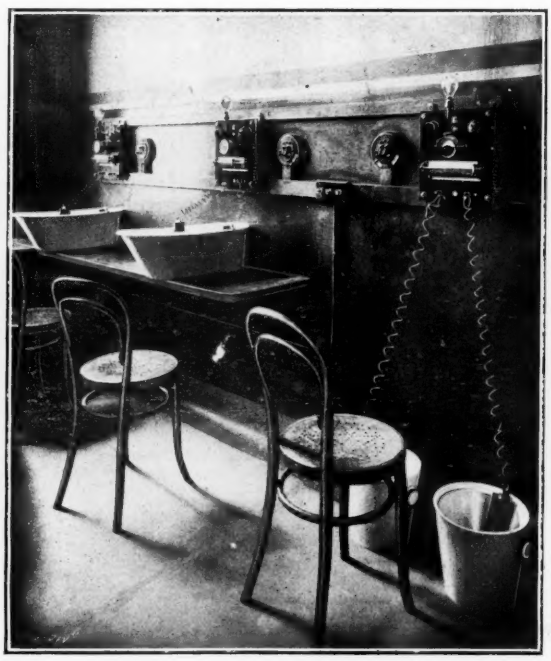
The general illumination of the wards is provided by means of three-light clusters suspended in the middle of the rooms, and each cluster is controlled by three switches. The latter are so arranged that one, two, or three of the lamps can be simultaneously alight, or one lamp connected in series with two in parallel, giving a subdued illumination of less than 1 c.p., which suffices for all ordinary purposes at night without interfering with the comfort of the patients.

In addition to the central clusters, a bracket lamp is hung on the wall near almost every bed, connected with one of Messrs. Lundberg's new combined switch-plugs; the bracket can be unhooked from the wall and stood on a chair, or held over the patient.

Each ward is also provided with a portable reflector lamp of 16 c.p., for use when examining a patient; if the patient is asleep, a resistance in the handle of the fitting can be switched into circuit, so that the lamp gives only about 1 c.p., thus avoiding any risk of waking the patient.



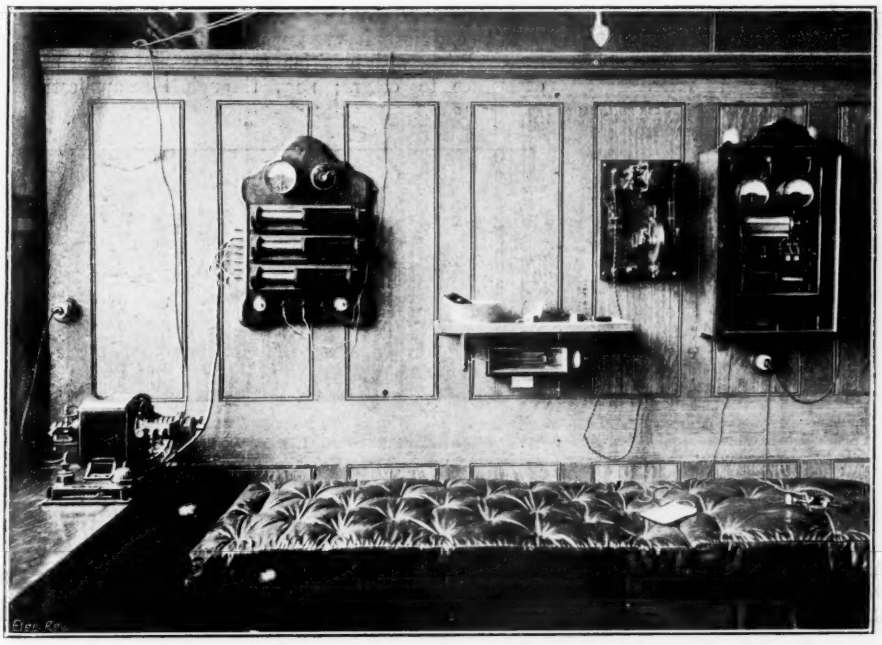
Stopping Room in the Dental Department, Showing the Suspended Electrical "Dental Engines."



Electric Baths for Faradic and Galvanic Treatment.

Portable trolleys are provided for administering faradic, galvanic and X-ray treatment in the wards; these are all worked off the bedside plugs.

The ordinary supply for lighting, at 240 volts, is derived from the Stepney Borough Council's direct-current mains, the circuits being arranged on either side of the three-wire system. This pressure, however, is unsuitable for use in connection with surgical apparatus, and in order to provide not only for these purposes, but also for emergency lighting in the event of a failure of the 240-volt supply—a most important consideration in the case of an operating theatre—a storage battery of 600 ampere-hours' capacity at 12 volts has been installed in the main building. This battery is charged by a motor-generator of the Crocker-Wheeler Co.'s make, giving 60 amperes at 15 volts, and situated in a cupboard near the operating theatres.

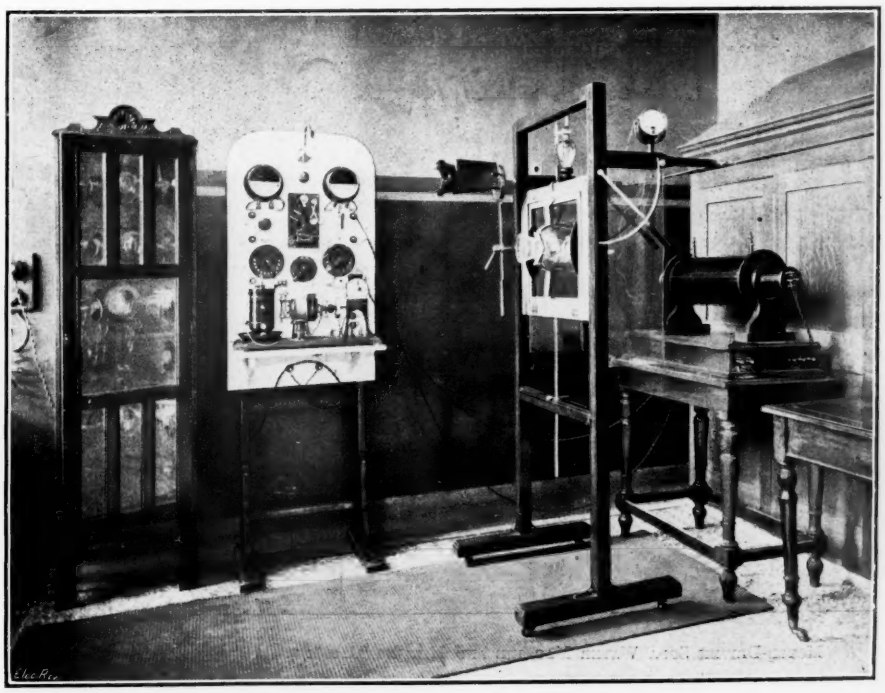


Three-Phase Rotary Converter and Induction Coils, Cautery, Commutator, and Galvano-Faradic Switchboard.

The 12-volt supply is a great convenience, and being derived from a central point, it has the advantage of doing away with the numerous portable batteries which would otherwise be required. The current is used for energising cautery burners, cystoscopes, forehead lamps, electro-magnets for removing particles of iron from the eye, for emergency lighting and for electric bells.

A very neat and compact apparatus, illustrated on p. 768, is fixed in each theatre, and hangs near the operating table at a height of a little more than 6 ft. from the floor. This fitting contains resistances for the cautery and various lamps supplied from the 12-volt mains, a voltmeter showing the operator what pressure he is using on these lamps, and five wall-sockets of different sizes: one for 240-volt lamps or a small motor for drilling bone; one for lamps on the 12-volt supply; one for ordinary cauteries; one for specially large cauteries taking about 60 amperes, and one for a ½-H.P. motor used for sawing bone, or for large drills. The resistances are regulated by means of sliding rods ending in rings, which may be seen under the fitting, and the flexible wires are kept out of the way of the operator by means of a special spring attachment.

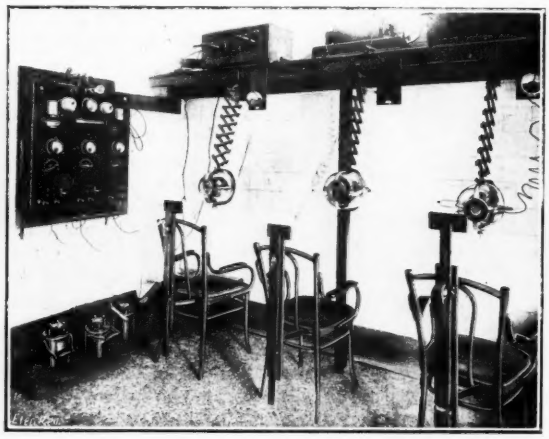
In the Out-Patients Department electricity is very extensively used for a variety of purposes. Besides the 240-volt and 12-volt supplies, which are taken to most of the rooms, several of the latter are provided with a 70-volt supply derived from an E.C.C. rotary transformer, which gives 200 amperes and runs practically all day; this, with a 600-ampere-hour 12-volt battery and a motor-generator for charging the latter, is installed in a small transforming station on the roof (illustrated on p. 765).



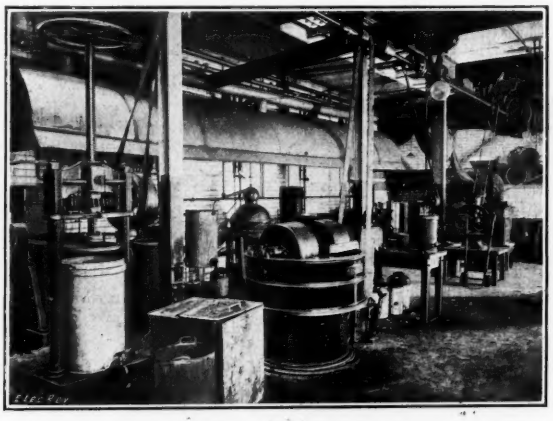
New X-ray Apparatus for Measured Treatment.

The most important department is, of course, that which is devoted to the treatment of lupus by means of the Finsen light; this was the first of its kind to be started in this country, and was founded by Her Majesty Queen Alexandra (then Princess of Wales), in 1900.

Since that date the department has been entirely reorganised, and an additional lamp, the gift of Sir Alfred Harmsworth, has been installed. Each of these large lamps treats four patients at a time, as shown in the illustration on p. 765. There are also four small lamps, two of which are of very recent introduction, each capable of treating one patient; one of these is seen in the illustration. All the lamps in this department are supplied with current at 70 volts.

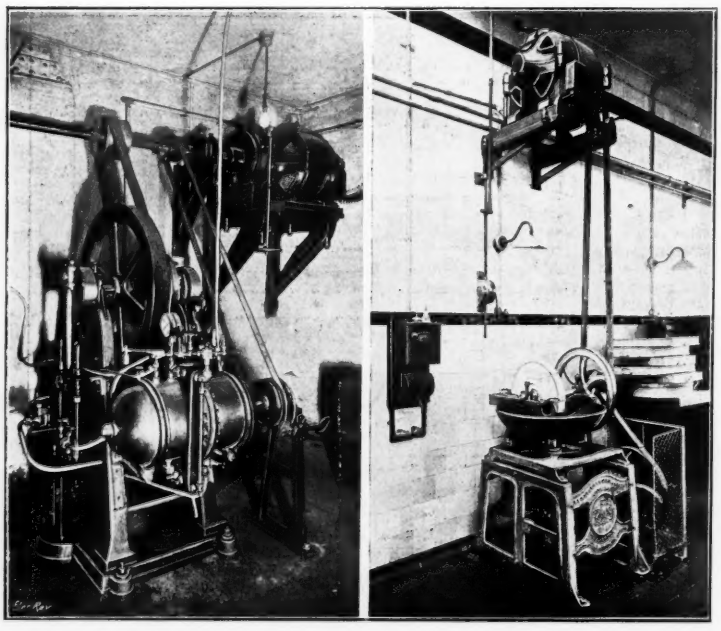


X-ray Apparatus.

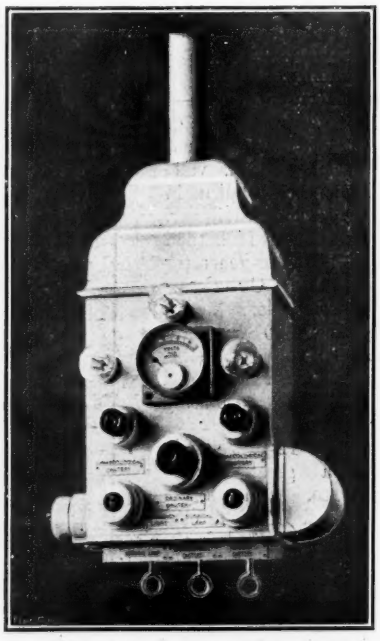


Motor-Driven Machines in the Laboratory.

Various other diseases of the skin are treated in the adjoining rooms with high frequency currents and X-rays. Dr. Sequeira, who is in charge of the Finsen light department, has recently introduced a new apparatus whereby, for the first time, it has been made possible to apply X-rays with a high degree of precision; this apparatus is illustrated on p. 767. The switchboard is fitted with instruments for measuring the primary current going to the induction coil, and carries also a motor-driven circuit-breaker of the mercury type, to which is attached a regulating dial and automatic cut-off. The dial can be set to any prescribed total number of interruptions, at any desired rate per second, and automatically cuts off the current when the dose is completed. The current in the secondary circuit—that is, through the tube itself—is also measured directly, and the quality of the tube is ascertained by means of a diaphragm provided with a number of disks of metal of various thicknesses, in such a way that at any future date, and with any tube, a given effect can be reproduced to a high degree of accuracy. Hitherto, although an operator could acquire by experience an approximate knowledge of the results he was likely to obtain under certain conditions, it was impossible for him either to record the conditions with precision, or to communicate his personal experience to others; now, through the application of scientific method, of which the fundamental characteristic is measurement, to the subject, it has become possible for the physician to write out a prescription for the dose of X-rays required, with full confidence that his assistants will be able to administer it in quantity and quality precisely as he dictates. The full meaning of this important advance will be better appreciated if we point out that in the treatment, for example, of ringworm, which is at present being reduced to an exact science at the London Hospital, an error in defect will result in failure to remove the whole of the hair affected with one application of the rays, while an over-dose will result in the destruction of the hair follicles, and therefore, permanent baldness. Now it has become possible by means of a single operation to remove the whole of the hair on the diseased part, with the certainty that it will grow again, and without affecting the adjoining parts. The operator is shielded from the direct action of the X-rays by means of



Motor-Driven Soda Water Machine and Mincing Machine.



Special Fitting for Operating Theatre.

lead glass plates, and in the same way the action of the rays is confined to a region of any desired area. The apparatus, we may add, is made by Messrs. A. E. Dean & Co., of London. An ordinary X-ray equipment is shown in the illustration on p. 768 ; this is constantly in use for the treatment of diseases of the skin.

The radiographic or skiagraphic department occupies several rooms, of which we are able to show one only, dark rooms being naturally ill-adapted for being photographed. Our illustration (p. 766) shows the large frame which is used for the localisation of foreign bodies, fractures, diseased portions, &c., in the human subject ; an X-ray tube may be seen suspended over the operating table, and another beneath it, radiograms from the two opposite points, by using the upper table, enabling the depth of the shadow-producing substance to be determined. This department is in the charge of Mr. Harnack, whose name is a household word with radiographers.

Other rooms are utilised for the accommodation of apparatus for the application of faradic and galvanic currents, three-phase and single-phase alternating currents, and static electricity. Electric baths for arms and legs, and electric plunge baths are included ; the former may be seen in the illustration on p. 766. The use of faradic and galvanic currents presents no novelty, but the employment of three-phase currents is entirely new and special to the London Hospital, the apparatus having been made to the designs of Dr. Morton, who controls this department. Our illustration on p. 767 shows the apparatus in question, consisting of a rotary converter and a set of three induction coils, with regulating apparatus ; the switchboard on the right hand is of the ordinary galvano-faradic type, and the apparatus on the wall adjoining it is another new device of Dr. Morton's, which we shall describe later. The use of three-phase currents is a development which will, no doubt, surprise our readers. It certainly shows that the London Hospital does not hesitate to take advantage of every possible means to mitigate the sufferings to which so many of us are liable. The converter is fed direct from the 240-volt mains, but runs very slowly, giving frequencies variable at will from 2 to 5 or 6 cycles per second ; the currents are led through the primaries of the three induction coils, the secondaries of which slide over the primaries so as to provide a wide range of regulation. A milliammeter is connected in series with one of them. The special uses of the three-phase currents are in the treatment of affections of the internal organs, the application being made by means of three electrodes, forming with the body a kind of delta system, and causing the currents to flow in varying directions through every part of the interior. Valuable results have already been obtained with this apparatus.

The other apparatus above mentioned consists of a disk with copper segments fixed round its circumference, of which each alternate one is dead, whilst the intervening segments are connected alternately to the positive and negative poles of the 240-volt mains through suitable resistances. Two brushes bear upon the circumference of the disk, and can be moved relatively to one another. With this apparatus rectangular waves of alternating polarity are obtained, somewhat after the fashion of the secondary or faradic current derived from an induction coil, but with this fundamental difference, that the frequency, duration, and intermittency of the current, as well as its strength, are all under perfect control. Here again, it will be seen, the principle of exact measurement has been introduced, with remarkable results. By suitable adjustment, Dr. Morton has found it possible to contract a muscle entirely without pain—an important feature, for example, in the treatment of young children, many of whom cannot be treated without the use of anaesthetics, on account of the painful sensations due to the induction coil commonly used. This, of course, is only one of the many advantages gained by the use of the apparatus ; the frequency can be varied up to 300 or 400 alternations per second, and every "ingredient," so to speak, can be varied at will, or reproduced with certainty and exactitude, thus rendering the operator independent of the vagaries of the induction coil with its troublesome contact-breaker.

The remaining apparatus in this department consists of a 12-volt cautery, shown in the figure, a large Wimshurst machine, and a motor-generator giving sinusoidal alternating currents (now being replaced by a new one).

Two Dowsing heat baths are fixed in the basement. In the Aural department a large number of special focus lamps are used, and numerous 12-volt cauteries. The Dental department, which is illustrated herewith (p. 766), is equipped with five electric motors, four of which are used for driving dental "engines," those instruments of torture, and one for sharpening instruments. The former are controlled by foot regulators, seen in the illustration. Tilting suspended lamps and fixed lamps on the operating tables are provided. For the Ophthalmic department a large number of special examining lamps have been supplied by Messrs. Curry and Paxton ; these are arranged so that the light can be thrown in any desired direction, and they are provided with resistances by means of which its intensity can be varied from 1 to 32 c.p.

The large waiting hall for the out-patients, which provides accommodation for about 800 people, is lighted by means of six arc lamps, supplied by the Westminster Engineering Co.

Turning to the heavier applications of electricity, in addition to six hydraulic lifts and a large number which are worked by hand, there are six which are electrically operated. Four of these are of Messrs. Waygood's make ; one was supplied by Messrs. Crompton & Co., Ltd., and one, which is being installed in the new Nurses' Home, was made by Messrs. J. Richmond & Sons, and is of their new "Richmond-Carey" automatic press-button type. Nearly all the medicines, pills, lozenges and tablets required for use in the Hospital are made on the premises, the dispensary laboratory being provided with 15 machines for this purpose ; these are driven by two E.C.C. motors, one of 10 and one of 15-h.p. We give a view on the opposite page showing the latter driving a length of shafting. Another view shows the soda-water machine, which is worked by an E.C.C. 5-h.p. motor, in a separate room.

A large refrigerating plant is provided, close to the mortuary ; this is driven by a 13-h.p. E.C.C. motor, and, besides circulating cold air through the mortuary, manufactures ice for use in the hospital. In the kitchen there is a large mincing machine, driven by a 4-h.p. motor, as shown in the illustration on p. 768. A small motor is also provided to drive a machine for grinding and polishing the knives. The laundry is one of the largest private laundries in this country, dealing with about two million pieces annually ; it is for the most part worked by steam, but the blowers which circulate air through the drying closets, having to work longer than the other machinery, are driven by two 4½-h.p. electric motors. In the room where the surgical instruments are kept, a 2-h.p. motor is installed for grinding and polishing them ; and in the sterilising room, in addition to a steam steriliser for general work, there is an electric steriliser for catgut. The remainder of the motors, numbering about 85, are used for driving ventilating fans of various sizes.

It will be seen that the electrical equipment of such an establishment as the London Hospital forms an installation of no mean magnitude and of the most varied scope. In fact, the Hospital is the largest single consumer of the Stepney Borough Council's electricity department, and obtains its supply on the maximum demand system at 8d. and 1d., at an all-round price of no more than 1·6d. per unit ; moreover, arrangements are now being made whereby it is hoped the price will be reduced to less than 1½d. per unit next year. The supply is derived from the mains at several points, but to guard against a total failure of supply, the question of putting down a steam dynamo to act as a stand-by is under consideration. The reason why a complete generating plant has not been installed appears to be the very low inclusive price charged by the Council. Mr. E. Delerset is the chief electrician. To him, to the consulting engineer (Mr. H. J. Wagg), and to every member of the hospital staff, visiting or resident, with whom it has been our good fortune to come into contact, we tender our sincere thanks for the ready courtesy which was invariably extended towards us.

CONTRACTS CLOSED.

(*Concluded from page* 764.)

Mexico.—The Railway and General Engineering Co., Ltd., Nottingham, have received an order for one of their Brown-Crosta patent electrically-driven tramway rail grinders to be supplied to the Mexican Tramways, Ltd., through the consulting engineer, Mr. Fearnside Irvine.

Pontypridd.—The D.C. has accepted the tender of the Brush Co. for the new overhead equipment, and that of Messrs. Henley & Co. for the cable laying on the Tredsfod route.

Ramsgate.—The local Electric Supply Co. has secured the contract for installing the electric light in St. Mary's Church.

Reigate.—The T.C. has accepted the tender of the General Electric Co., Ltd., for the maintenance of meters at 4s. each for the first year, and 3s. for the second.

Salford.—The T.C. has accepted the tender of the Sturtevant Engineering Co., Ltd., for the supply of motor starters.

Stoke-on-Trent.—The B.G. has accepted the tender of Messrs. Blackburn, Starling & Co., Hanley, for re-wiring the Cottage Homes and portions of the Workhouse for the electric light, at £266, and that of the Hart Accumulator Co., Ltd., for renewing battery at the workhouse, Newcastle, Staffs., with 114 of their standard lighting type cells, at £258.

FORTHCOMING EVENTS.

To-day's Events (Friday, November 10th).—At 8 p.m. Physical Society. Meeting at Royal College of Science. Mr. James Swinburne on "The Question of Temperature and Efficiency of Thermal Radiation."

Saturday, November 11th.—At 7.30 p.m. Birmingham and District Electric Club, at Colonade Hotel. Discussions on "Direct *v.* Alternating Current Motors," led by Mr. J. A. Jeckell; "Copper *v.* Carbon Brushes," led by Mr. W. Smith; "Telegraphs and Telephones," led by Mr. W. H. Whitehouse.

Monday, November 13th.—Institution of Mechanical Engineers (Graduates). Mr. E. Barrs, on "Boiler-House Practice and Design."

Tuesday, November 14th.—At 8 p.m. I.E.E. (Glasgow). Meeting at the Institution of Engineers and Shipbuilders. Inaugural Address by Mr. J. M. M. Munro.

At 8 p.m. Institution of Civil Engineers. Paper by Mr. J. A. Saner "On Waterways in Great Britain," for discussion.

Wednesday, November 15th.—At 8 p.m. Society of Arts. Inaugural Address by Sir Owen Roberts.

At 7.30 p.m. I.E.E. (Opening Students' Meeting.) Mr. W. M. Mordey on "Some Aspects of Electric Traction."

Thursday, November 16th.—At 8 p.m. Rugby Engineering Society. At Benn Building, Messrs. J. Brierley and T. Robertshaw on "The Generation of Steam."

At 8.30 p.m. Chemical Society Meeting.

Friday, November 17th.—At 7.30 p.m. I.E.E. (Manchester), Opening Meeting at the Grand Hotel. Address by Chairman, Mr. S. L. Pearce. Smoking Concert to be held at the close of the Address.

At 8 p.m. Electro-Harmonic Society Concert (Ladies' Night) in the King's Hall, Holborn Restaurant.

At 8 p.m. Institution of Mechanical Engineers at Storey's Gate. Reading and discussion of the Seventh Report to the Alloys Research Committee "On the Properties of a Series of Iron-Nickel-Manganese-Carbon Alloys," by Dr. H. C. H. Carpenter, Mr. R. A. Hadfield and Mr. P. Longmuir.

Saturday, November 18th.—At 7.30 p.m. Glasgow Technical College Scientific Society, Mr. A. M. Downie on "The Commercial Efficiency of Prime Movers."

Wednesday, November 22nd.—I.E.E. (Birmingham). At the University. Address by the Chairman, Prof. R. Threlfall, F.R.S.

During November.—Tramways and Light Railways Association. Lecture on "The Paving of Roadways." Visit to Holborn and Strand Subway.

THE ELECTRICAL ENGINEERS R.E. (VOLS.).

THE following orders are issued:—

Monday, November 13th.—"A" Company, recruit drill 6 p.m. Technical instruction (for all) 7 p.m.

Tuesday, November 14th.—Medical examination and enrolment of recruits 7 p.m. "B" Company, technical instruction 7 p.m.

Thursday, November 16th.—"C" Company, technical instruction, "A" Badge men and recruits 7 p.m.

Friday, November 17th.—"D" Company, technical instruction 6 to 10 p.m.

Saturday, November 18th.—Refreshing course technical instruction, N.C.O.s "A" and "D" Companies, commencing at 3 p.m.

J. H. S. PHILLIPS, Captain.
For O.C.E.E.R.E. (V.)

London Traffic Board.—It is stated by the Exchange Telegraph Co. that the Government propose to take steps to introduce a Bill next Session for the establishment of a Traffic Board for London on the lines recommended by the Royal Commission. The Board of Trade have been asked to consider whether any schemes for new railways in London will be allowed to proceed during the coming Session, the 15th inst. being the last day upon which notice can be given by the promoters.

PROVISIONAL ORDERS.

As we go to press we have received the following important communication from the Board of Trade. Its tendency is most salutary; our only regret is that it did not come ten years ago!

"*November 7th*, 1905.

"ELECTRIC LIGHTING ACTS, 1882 AND 1888.

"I am directed by the Board of Trade to state that their attention has been called to the large number of instances in which they have in recent years found it necessary to revoke provisional orders which have been obtained by local authorities under the Electric Lighting Acts, or in which local authorities having obtained provisional orders have entered into agreements with companies for carrying the order into effect, these agreements being in many cases *ultra vires*, or at least of doubtful validity.

"It appears to the Board that it is undesirable that a local authority should apply for a provisional order without having a definite intention of exercising the powers under the order when obtained, and in future the Board will not be prepared to grant an order to a local authority unless they are satisfied that the powers will be exercised either by the local authority themselves, or in exceptional cases by a company (to be named in the order) where special power is taken to transfer to the company within a limited period.

"I am at the same time to state that the Board have observed that there is a growing practice for individuals or unregistered companies or firms to apply for provisional orders under the Electric Lighting Acts. In such cases the Board, having in view the undesirability of individuals or unregistered bodies exercising statutory powers involving the breaking up of streets, have inserted in the order, as granted, a provision that the powers under the order shall not be exercised unless within a fixed period they are transferred to a registered company approved by the Board. In the majority of cases the company is named in the order.

"This procedure has proved to be unsatisfactory and inconvenient; in some cases the orders have lapsed by reason of the grantees being unable to form a company with a capital sufficient for the purposes of the undertaking, and in others the submission to the Board of the proposal to transfer has been postponed to so late a date as to leave insufficient time for the due consideration of the matter.

"In these circumstances the Board have decided that, in regard to any future application of this nature, they will require that the proposal to transfer shall be submitted to the Board not less than three months before the expiration of the period fixed by the order for the completion of the transfer.

"I am, your obedient servant,
"T. H. W. PELHAM."

NOTES.

Proposed "Archibald Head" Memorial.—We are asked to announce that it has been decided to raise a fund in memory of the late Archibald P. Head, who met his death in the "20th Century, Ltd.," train in America. For this purpose a small Committee with Sir Alexander B. W. Kennedy as chairman has been formed to raise a fund to establish a gold medal or scholarship in connection with the engineering department, University College, London. There are, no doubt, among our readers a number of friends and old college students of the late Archibald Head, whose present addresses the Committee has not been able to obtain, but who would be glad to avail themselves of the opportunity of doing something to perpetuate his memory. They should send their contributions for the above fund either to the hon. treasurer, Mr. C. T. Millis, Borough Polytechnic, London, S.E., or direct to Messrs. Hoare, bankers, 37, Fleet Street, "for the Archibald P. Head Memorial Fund Account."

British Motor Boat Club.—The first annual dinner of the British Motor Boat Club will be held at the Hotel Cecil, on Friday, December 1st.

The British Science Guild.—We are informed that the inaugural meeting of the British Science Guild has had the effect of largely increasing the list of applications for membership. Sir Norman Lockyer desires it to be known that would-be members should apply for particulars to the hon. secretary, 16, Pen-y-Wern Road, S.W.

A Consulting Engineer's Fees.—A difference between Mr. H. F. Parshall and the Newport Corporation as to the former's claim of £688 1s. for services rendered and expenses, has been settled by Mr. Parshall's acceptance of a cheque for £450 in full settlement.

An Electrical Engineers' Dance at Manchester.—A dance is being organised by a number of the leading electrical men in the Manchester district. It is to be held at the Midland Hall, Manchester, on Friday, December 15th, and tickets, which are one guinea each, inclusive of supper and wine, can be obtained from any member of the General Committee, which is constituted as follows, the Executive Committee being indicated by asterisks:—Messrs. *L. Andrews, C. B. Auel, S. E. Bastow, M. B. Cottrell, E. A. Claremont, W. P. J. Fawcus, R. Loraine Gamlen, F. C. Gibbons, Dr. E. Hopkinson, N. Kilvert, H. S. Loud, *G. F. Metzger, S. L. Pearce, *R. O. Ritchie, Dr. Schuster, *F. Sells, *C. D. Taite,

*B. Thomas, S. J. Watson, A. P. Wood. Mr. G. W. Lowcock, of 57, King Street, Manchester, is acting as honorary secretary, and Mr. F. A. C. Leigh, 78, King Street, Manchester, is treasurer. The Electrical Review heartily wishes the organisers of the movement, and all of its local friends who are interested therein, a most complete success in their efforts. If we may judge from the constitution of the committee—which is representative of professional, manufacturing and trading sections of the electrical undertakings of this important centre—then the success of the Electrical Engineers' Dance at Manchester is sure to be all that can be desired.

Entertainment of Kindred Institutions by the Institution of Electrical Engineers.—We learn from the secretary (Mr. G. C. Lloyd) of the Institution of Electrical Engineers that arrangements have been set on foot by the Council of the Institution to entertain next year the kindred Institutions in Europe and America who, as it will always be remembered, have shown such lavish hospitality to the members during their visits abroad. Official invitations to visit Great Britain as guests of the Institution have been sent to:—

The American Institute of Electrical Engineers;
The Canadian Electrical Association;
The Associazione Elettrotecnica Italiana;
The Elektrotechnischer Verein;
The Verband Deutscher Elektrotechniker;
The Schweizerischer Elektrotechnischer Verein; and
The Société Internationale des Electriciens.

The date for the arrival of the foreign guests has been fixed for the last week in June, 1906, and the visit will probably extend over about a fortnight. The programme exists, of course, in outline only as yet, but the present idea is to spend about one week in London, which will give an opportunity to the guests to see the new electrical developments and to make excursions in the neighbourhood. It is then proposed to make a tour through some of the principal industrial centres in the United Kingdom, to visit works, and to provide local entertainments for the visitors.

Those who took part in the various foreign tours are labouring under a debt of gratitude to their quondam entertainers which may now be suitably acknowledged, though it can hardly be repaid. It is to be hoped that every member who can even in the smallest degree contribute to the enjoyment, instruction and general well-being of the visitors will put forth his utmost endeavours to this end. The British electrical industry, as a whole, has profited abundantly by their whole-hearted hospitality, and it will be a point of honour to see that our guests are received and entertained in a fashion which, while it could not possibly excel the former, shall at any rate not fall far behind, and shall be worthy of those hospitable traditions upon which Britons have always prided themselves.

Shock Fatality.—It is reported that a fatal accident occurred on Saturday at the power station of the Hammersmith Borough Council's Electricity Department, Fulham Palace Road, S.W. An electrician, named Arthur T. Boswell, aged 24 years, was engaged at work when, by some means, he received a shock at 2,500 volts, and was killed. Several fellow mechanics were witnesses of the occurrence.

At the inquest it was stated that deceased went to the distributor board to remove an ammeter. According to instructions, when working in "danger zone," he was supposed to wear rubber gloves and stand on a rubber mat to completely insulate himself, but instead of doing so he tried to remove the ammeter without wearing the gloves and standing with one foot on the mat and one on the stone floor. This caused an "earth," and as soon as Boswell turned the key to remove the meter he received a shock, and died almost instantly. Dr. Townsend said the only external injury was a burn on the right hand where he had clutched the key. The jury returned a verdict of "Accidental Death."

Appointments Vacant.—Car-shed foreman for Scarborough tramways (£2); switchboard attendant for Eccles (24s.).

Fatality.—An inquest was held on Saturday at Cheltenham concerning the death of John Moore (27) who died from scalds received in cleaning the purifier of a Babcock boiler, at the electric light works. Deceased had been employed at the works for 2½ years, and part of his work was to clean out the purifiers. On this occasion when partly inside a boiler, he sent a fellow workman for some packing. Upon his return, the workman found the deceased had been scalded. Deceased must have turned on the cocks inside the boiler, and without warning, the stoker turned on steam to the boiler in question, with the result that he was shockingly scalded about the head and shoulders. The verdict was that "Death was due to septic absorption and exhaustion following scalds accidentally received." The jury added a rider to their verdict to the effect that the accident was in a great measure due to the lack of rules and regulations at the electricity works, and suggested that more individual care should be taken by the workmen in future. The Town Clerk expressed the regret of the Corporation at the accident and said the jury's rider should be laid before the Lighting Committee.

Institution Notes.—Junior Institution of Engineers.—The annual general meeting of this Institution, which took place on October 27th (the retiring chairman, Mr. S. Cutler, jun., M.I.Mech.E., presiding) was also the first general meeting of the society after its constitution as an incorporated body, and was held under the requirements of the Articles of Association. After the usual routine business, the annual report of the Council was presented. Reference was made in it to the increase in membership to 888; to the visits to works, 32 in number; to the meetings, 11 of which had been held; to the celebration of the "coming of age" of the Institution; the growth of the library; and to arrangements which had been made for the ensuing session. The scrutineers reported that the election had resulted as follows:—Chairman, Mr. Adam Hunter, Assoc.M.Inst.C.E.; Vice-Chairmen, Messrs. Lewis H. Rugg, Assoc.M.Inst.C.E, and F. S. Pilling, M.I.Mech.E.; Hon. Librarian, Mr. E. Eade; Hon. Auditors, Messrs. P. L. Young and W. H. de Ritter, M.I.Mech.E.; Members of Council, Messrs. G. T. Bullock, F. R. Durham, Assoc.M.Inst.C.E., G. H. Hughes, M.I.Mech.E., and A. G. Young. Provincial Members of Council: North of England, A. E. Rasey, A.M.I.Mech.E.; Midlands, E. King, A.M.I.Mech.E.; Eastern Counties, J. Julian; Southern Counties, F. S. Miller; West of England, E. W. Porter, Assoc.M.Inst.C.E.; Scottish District, G. E. Jackson; Irish, W. E. Lilly, M.I.Mech.E.; Welsh, H. F. Hunt, B.Sc.

On November 3rd the inaugural meeting of the twenty-fifth session took place. In the absence of the retiring President, Mr. W. H. Lindley, M.Inst.C.E., who was detained by professional work in Roumania, the chair was taken by Sir William H. White, K.C.B., F.R.S., Past-President. Sir William White inducted to the chair the new President, Mr. Dugald Clerk, M.Inst.C.E., investing him with the badge. Mr. Clerk took as the subject of his presidential address "The Problem of the Gas Turbine," an abstract of which appears in another part of this issue.

At the meeting on December 8th, a paper on "Electric Mains for Power Transmission Work" will be read by Prof. John T. Morris, M.I.E.E. (Member). The other meetings, &c., of the new session have been arranged as follows:—

January 26th.—"Some Notes on Boiler Trials," by Prof. J. D. Cormack, B.Sc. (Honorary Member).
February 2nd.—"Some Recent Electrical Engineering Measuring Instruments," by Mr. Kenelm Edgcumbe, M.I.E.E. (Member).
February 10th.—Anniversary Dinner in the Victoria Hall of the Hotel Cecil.
February 15th.—"Architectural Design and Expression," by Mr. H. Heathcote Statham.
March 2nd.—"Gas Engine Indicators," by Mr. L. F. de Peyrecave, Stud.I.C.E. (Member).
March 10th.—Conversazione. A lecturette on "The Evolution of the Man-of-War," illustrated by lantern slides kindly lent by the Navy League, will be given during the evening by Mr. C. Alfred Smith, B.Sc. (Member).
April 11th.—Joint meeting with the Discussion Section of the Architectural Association, at 18, Tufton Street, Westminster (near the Church House and Westminster Abbey), commencing at 7.30 p.m. Paper on "Ferro-Concrete," by S. N. Pylander, Mem.J.Inst.E.
April 20th.—"The Internal Combustion Engine as Applied to Marine Purposes," by Mr. Francis J. Maddox, Stud.Inst.C.E. (Member).
May 11th.—"The Structural Design of Factories," by Mr. Adam Hunter, Assoc.M.Inst.C.E. (Chairman).

Birmingham and District Electric Club.—Last Saturday evening a paper on "Electric Furnaces" was given by Mr. J. H. Stansbie, at the Municipal Technical School.

Royal Institution.—A Christmas course of lectures, adapted to a juvenile auditory, will be delivered by Prof. H. H. Turner, D.Sc., F.R.S., on "Astronomy," on December 28th and 30th, 1905, January 2nd, 4th, 6th and 9th, 1906, at 3 o'clock.

A general monthly meeting was held on Monday. Dr. A. Muirhead was elected a member.

Society of Engineers.—On Monday evening a paper was read on "The Metallic Preservation and Ornamentation of Iron and Steel Surfaces," by Mr. Sherard Cowper-Coles. The greater portion of the paper was devoted to the author's new process of dry galvanising or "Sherardising."

Society of Arts.—The Society commences its 152nd session on the 15th inst., with an opening address from the chairman of its council, Sir Owen Roberts. Among the papers set down for the Wednesday evenings before Christmas is one on "The Commerce and Industries of Japan," by Mr. W. F. Mitchell, at which the Japanese Minister will preside. Sir William Preece will also give an account of the doings of the British Association in South Africa last summer, and Mr. F. Martin Duncan will describe the recent applications of the cinematograph for scientific purposes. A course of Cantor lectures by Prof. J. A. Fleming on "Electric Waves" will also be given before Christmas. Among the courses of lectures announced for the meetings after Christmas is one under the Cantor Trust on "Modern Warships," by Sir William H. White, and one under the Howard Trust, by Prof. Silvanus P. Thompson, on "High-Speed Electric Generators." The usual course of juvenile lectures will be given this year by Prof. Herbert Jackson, the subject being "Flame and Combustion."

Rugby Engineering Society.—On Thursday, November 2nd, Mr. T. S. Dick read a paper on "Impact Testing of Metals."

The Institution of Civil Engineers.—At the inaugural meeting of the session, held on Tuesday, Sir Guilford Molesworth, K.C.I.E., the retiring President, formally introduced to the members his successor in the Chair, Sir Alexander Binnie. Sir Alexander then delivered an address to the members, in which he traced the influence of scientific thought and investigation upon the development of engineering practice. The President subsequently presented the medals and premiums awarded by the Council for papers dealt with in the course of the past session, and afterwards received the members in the library.

Electro-Harmonic Concert.—Mr. W. E. L. Gaine is to preside at the next concert (Ladies' Night), which is to be held in the usual place—King's Hall, Holborn Restaurant—on Friday next, November 17th. The programme includes songs by Miss Annie Bartle, Miss Lucie Johnstone and Mr. John Bardsley; and instrumental music by the orchestra. Other items in the programme will be rendered by Mr. Percy French (the art humorist), Mr. Edward Minshall, who will give humorous recitations, and Mr. Nelson Jackson (humorous sketches).

Electric Everything.—In the Shoreditch County Court, before his Hon. Judge Smyly, K.C., on Tuesday, Samuel Ringwood, a cabman, of 268, Ramsey Road, Forest Gate, E., was sued under a judgement summons, but said he could not pay. His Honour: When can you pay? Defendant: I really don't know, it's all up with the show now. His Honour: All up with what show? Defendant: With the cabmen's show. It's electricity everywhere now. Electric cars, electric trams, electric 'buses, electric cabs, in fact, electric everything. His Honour: But you must pay a debt. Defendant: Very well, if you can stop the electricity, I can pay my debts, but otherwise I'm done. His Honour: Does electricity affect you so badly as that? Defendant: It does, indeed. His Honour: Very well, I will adjourn this case for the parties to come to an arrangement, if possible.

Concert.—A Bohemian Concert is to be held by the Eltradion Athletic Club on Saturday, November 11th, at 8 p.m., Mr. A. Ewer, president, in the chair. It will take place at the University Tavern, Chenies Street, Tottenham Court Road, W.

The Production of Platinum.—About 95 per cent. of the world's supply of platinum comes from the Ural Mountains. In 1902 this amounted to 6 tons, in 1903 the production only reached 5¾ tons, and in 1904 it was further reduced to 4·7 tons. Recently additional sources of the mineral have been discovered, so that a larger output may again be anticipated. A portion of the ore is exported, but most of it is refined before being sold.

Gas.—A gas explosion occurred on 31st ult. in the works of the Yorkshire Iron and Coal Co. at Tingley, and two workmen were badly burned.

Shock at a Bristol Fire.—A curious incident occurred during a great fire at Bristol on Saturday evening. The burning premises were not far from the tramway centre, and several lines of tramway pass the doors. Traffic had to be stopped for a good many hours on this piece of road, but the pressure remained on the trolley wires. A fire escape being called for, a fireman attempted to move one of large size towards the burning blocks, and one of its steel wire stays touched the overhead conductor. The fireman received a considerable shock, and muscular contraction prevented him releasing his hold of the escape. A police officer came to the rescue, but also received a shock, and failed to get the fireman's grasp released. Happily, a man with rubber gloves was at hand, and he accomplished what the constable was unable to perform. No serious injury resulted, but the fireman, as part of his very unpleasant experience, had the hand which had grasped the metal stay burned. He, however, continued with his comrades in the work of extinguishing the fire. The premises of Messrs. King & Co., electrical engineers, adjoin the burned warehouse, and some damage was done, chiefly by water.

25,000-Mile run of Electric Locomotive.—The New York Central locomotive No. 6,000, which is being tested at the Schenectady experimental track, and which was built by the General Electric Co. and the American Locomotive Co., made its 25,000th mile at 1.15 p.m. on October 20th, 1905, thus completing the first half of the 50,000-mile test to which it is being subjected. The motors on the locomotive to-day are those with which the test began; the commutators are perfectly smooth; the brushes have run the 25,000 miles with a wear of only ⅜ in., and appear fit to complete the 50,000 run. We are informed that during these tests, the locomotive has been in service regardless of weather, running light or with trains up to 12 cars in length. A speed of 85 miles an hour has been indicated, and in competition the electric locomotive has easily beaten the fastest steam trains on the New York Central. The total cost of all repairs on the locomotive, excluding the injury caused when the shed in which it was housed was burned, has, we understand, been $428.17 for 25,000 miles. This is an average of $0.017 per mile run, and there is every indication that there will be a material reduction of expense on the second half of this run.

OUR PERSONAL COLUMN.

[*The Editors invite electrical engineers, whether connected with the technical or the commercial side of the profession and industry, also electric tramway and railway officials, to keep readers of the* Electrical Review *posted as to their movements.*]

Central Station Engineers.—Mr. J. Ernest Doidge, who was for some little time with the Electric Supply Corporation, Ltd., as resident engineer of the Totnes and Exmouth Electricity Works, has been appointed resident electrical engineer of the Nundydroog Co., Ltd., and is leaving England next week. His address will be—c/o the Nundydroog Gold Mining Co., Ltd., Oorgaum, Mysore State, India.

In the New York *Electrical World and Engineer* for October 28th, just to hand, we read:—"Mr. W. H. Patchell, engineer-in-chief to the Charing Cross and City Electric Co. and the Charing Cross and Strand Electricity Supply Corporation, is now visiting this country for the first time, and studying American central station development and practice. He is making a tour of inspection in New York, Boston, and other cities. With him is Mr. W. F. Fladgate, chairman of the board of directors."

The Beckenham U.D.C. has decided to take over the staff of the Electricity Works (which have hitherto been leased to the B.I. and H. Co., and are in future to be worked by the Council) on November 22nd at their existing rate of pay, the question of the bonus which the resident engineer has been in receipt of being left over for further consideration.

The Leyton U.D.C. has increased the salary of the electrical engineer (who will undertake the management of the electrical equipment of the tramways) by £100 per annum, as from July 1st, 1905.

The Canterbury T.C. has increased the salary of Mr. F. E. Lewis, chief assistant electrical engineer.

The appointment of assistant engineer recently advertised for Maidenhead Corporation Electricity Works, has been filled by Mr. Audrey Fletcher, of the Charing Cross Co.

Mr. A. J. C. De Renzi, shift engineer at Rochdale Corporation Electricity Works, has been appointed assistant engineer at Newcastle-under-Lyme Corporation Electricity Works.

Tramway Officials.—Over 60 applications have been received by the South Shields T.C. for the post of general manager of the new electric tramways.

General.—Mr. Stainer Hutchins has resigned his position as assistant general manager with the Industrial Engiing Co., of Hyde, to enable him to devote the whole of his time to the perfecting of a new type of gas producing plant.

Readers in the Eastern Counties may be interested to learn that Mr. Harry Pullen, who was for eight years in the Royal Navy as engineer, and who left the service with most excellent testimonials from the Fleet Engineer, and his late Commander, as to his unusual abilities both in mechanical and electrical engineering, and also with regard to his personal character, has recently started business in Diss, Norfolk, as a motor-car, mechanical and electrical engineer. Mr. Pullen, who was well known to us before he joined the Royal Navy, was apprenticed to the mechanical engineering profession, and, from our own knowledge and experience of his skill, together with the high testimony to his abilities from his superior officers, we can confidently recommend Mr. Pullen to anyone having occasion to seek the services of a young, energetic and able engineer.

Mr. Noel Woodhouse, after being 12 years with the British Insulated and Helsby Cables, Ltd., Prescot, has resigned his position with the firm as assistant contracts manager, and has commenced business with his brother, Mr. Alfred V. Woodhouse, as electrical engineers and contractors. Mr. A. V. Woodhouse, after being with the Brush Co., was, until recently, chief assistant engineer at Penarth for the B.E.T. Co. Messrs. Woodhouse Bros. have taken offices at 20, North John Street, Liverpool, to which address all communications should be sent.

The Electricity Committee of Salford T.C. has presented the retiring chairman (Alderman Shaw, J.P.) with an address expressing appreciation of his valued services.

The *Times* says that the degree of Doctor of Science in Engineering has been conferred on Mr. Arthur Boyd, an internal student of King's College, for a thesis entitled "Experimental Researches on the Induction Motor" and an additional paper on the "Radical Deformations of Fly-Wheels."

It is announced that the Royal Society has this year awarded medals as below:—

The *Copley* medal to Prof. Dmitri Ivanovitch Mendeléef, of St. Petersburg, for his contributions to chemical and physical science.

A *Royal* medal to Prof. John Henry Poynting, F.R.S., for his researches in physical science, especially in connection with the constant of gravitation and the theories of electro-dynamics and radiation.

The *Davy* medal to Prof. Albert Ladenburg, of Breslau, for his researches in organic chemistry, especially in connection with the synthesis of natural alkaloids.

The *Hughes* medal to Prof. Augusto Righi, of Bologna, on the ground of his experimental researches in electrical science.

Mr. E. Stanley Shoults, A.M.I.E.E., has resigned his position as chief engineer and works manager of Aron Electricity Meter, Ltd., in London, which he has held for nearly four years.

Our congratulations to Prof. G. H. Darwin, F.R.S., president of the British Association, on his appointment to be a Knight Commander of the Order of the Bath (Civil Division).

Mr. Ed. C. de Segundo has been appointed consulting engineer to the Jew's Orphan Asylum at West Norwood, at which there is installed a very complete electric lighting, heating and laundry plant.

Obituary.—We learn with very deep regret that Mr. C. Grey Mott, the chairman of the City and South London Railway, and a director of the Great Western and other steam lines, passed away on Tuesday, at the age of 72 years, at Stanmore. His connection with the promotion and development of the first electric tube railway in London—indeed, in the entire world—has been his claim upon the interests of electrical men, and he stood by this concern through its prolonged uphill fight against circumstances, and against much opposition, convinced that eventually those who had a stake in the company would receive a just reward. At the last half-yearly meeting it was noticed that he was in an infirm condition, and he remained seated during his address to shareholders, but there was a ring of hopefulness in his remarks, even when referring to the ruinous and unfair competition of L.C.C. tramways. He has been so regular, so courteous and so greatly esteemed as chairman of these meetings that the next one will seem strange indeed without him. He had a great belief in the extension to Euston which is now constructing, believing that with the changing residential and traffic conditions of London the City and South London Railway would, by this extension, have contiguity to great railway termini there, and bring in vast volumes of traffic from the more distant suburbs to the metropolitan centres and take them out again, to the benefit of the public and the company. One cannot help regretting that he was not spared to

see this work completed, for this railway's interests seemed to be a large part of himself. To Mr. C. G. Mott, in the financial and promoting sense, as to the late Mr. Greathead and others in the engineering sense, Londoners owe the origin of the tube railway now so much in vogue. It was in the early eighties that he found the funds for the City and South London.

NEW COMPANIES REGISTERED.

British Hosiery and Electrolytic Bleaching Co., Ltd. (86,337).—This company was registered on November 2nd, with a capital of £60,000 in £1 shares, to acquire the business of manufacturers of meat coverings, lace, lace fabrics and hosiery, and of bleachers, carried on by the Sanitary Meat Coverings, Ltd., at 44, Parliament Street, Nottingham, to acquire certain patents relating to the Vogelsang Electrical Bleaching Process, now belonging to the Foreign Electrical Bleaching Patents, Ltd., to acquire from R. F. Blair, of St. George's House, Eastcheap, E.C., certain patents relating to improvements in circular knitting and splicing machines, and to carry on the business of manufacturers of meat coverings, lace, hosiery, lace and lace fabrics, commission merchants, spinners, dealers in wool, cotton, silk, hemp, flax, jute and other fibrous substances, bleachers, dyers, dressers and finishers of meat coverings, lace, hosiery and other materials, &c. The subscribers are:—A. P. Stokes, 13, Leadenhall Street, E.C., solicitor, 2,250 shares; C. L. de Chastillon, 103, Rue La Fayette, Paris, shipownerr, 250 shares; F. W. Roper, 92, Watling Street, E.C., merchant, 250 shares; A. Morum, St. Michael's House, Church Alley, Basinghall Street, E.C., merchant, 250 shares; W. Lewin, 44, Parliament Street, Nottingham, merchant, 250 shares; W. Carsley, St. Michael's House, Church Alley, Basinghall Street, E.C., merchant, 1 share; R. F. Blair, 6, Eastcheap, E.C., merceant, 1 share. Minimum cash subscription, £14,000. The number of directors is not to be less than three nor more than seven; the first are C. L. de Chastillon, A. Morum, A. L. Radford, F. W. Roper, and A. P. Stokes; qualification, £250; remuneration as fixed by the company. Registered office, 6, Eastcheap, E.C.

P. M. Electric Manufacturing Co., Ltd. (86,307).—This company was registered on October 30th, with a capital of £2,000 in £1 shares, to carry on the business of manufacturers of and dealers in electrical apparatus, sparking plugs, induction coils, tremblers and all accessories, parts or articles used in connection with the electrical portion of motor-cars, launches and omnibuses and other self-propelled vehicles, manufacturers and vendors of electrical apparatus of any kind, &c. The first subscribers (each with one share) are:—J. Edwards, Cricklewood Lane, N.W., clerk; W. T. Jaye, 3, Effingham Road, Hornsey, N., clerk; Rev. W. Wheeler, Ivy Dene, Estcourt Road, Woodside, S.E.; W. R. Bradlaugh, 70, King's Cross Road, W.C., journalist; J. Jones, 67, Arabin Road, Brockley, S.E., printers' overseer; A. Davis, 32, New Buildings, Hampstead, N.W.; and P. Baxter, 6a, Tudor Street, E.C., engineer. No initial public issue. The number of directors is not to be less than two nor more than seven; the first are P. Baxter (permanent), and another or others to be appointed by the subscribers. Article 14 provides that "the company is to be dissolved so soon as the re-sale referred to in Clause 3 (sub-section 'A') of the memorandum of association shall have been effected"; but the said sub-section "A" appears to merely give the company general powers to acquire any business relating to the manufacture and sale of electrical apparatus.

J. S. Fairfax & Co., Ltd. (86,317).—This company was registered on October 31st, with a capital of £12,500 in £1 shares, to adopt an agreement with J. S. Fairfax for the acquisition of certain patents granted to him, and to carry on the business of mechanical, hydraulic, marine, electrical, traction and general engineers, machine tool manufacturers, builders of motor and other vehicles, boats and launches, generators, users and suppliers of electrical energy, &c. The first subscribers (each with 50 shares) are:—J. S. Fairfax, 37 and 39, Essex Street, Strand, W.C., consulting engineer; C. Hawksley, 30, Great George Street, Westminster, S.W., civil engineer; A. Rigg, 42, Old Broad Street, E.C., mechanical engineer; K. P. Hawksley, 30, Great George Street, Westminster, S.W., civil engineer; Mrs. I. L. A. Hawksley, 56, Ladbroke Grove, Notting Hill, W.; Mrs. L. Fairfax, Sunview, Fanconberg Road, Chiswick; and Miss A. Hawksley, 60, Porchester Terrace, Bayswater, W. No initial public issue. The subscribers are to appoint the first directors; qualification, 50 shares; remuneration as fixed by the company. Registered office, Kew Bridge Engineering Works, 100 and 102, Strand-on-the-Green, Chiswick, W.

South American Traction Co., Ltd. (86,332).—This company was registered on November 1st, with a capital of £10,000 in £1 shares, to carry on in South America or elsewhere the business of contractors for public and other works and conveniences, tramway, railway, omnibus and van proprietors, carriers, manufacturers of tramway and railway carriages, trucks, locomotives, accumulators, dynamos and accessories, suppliers of electricity for light, heat, motive power and other purposes, &c. The first subscribers (each with one share) are:—W. J. Hill, 14, St. Helen's Place, E.C., clerk; W. Waters, 10, Stonard Road, Palmer's Green, N., clerk; R. Cherkin, 14, St. Helen's Place, E.C., clerk; R. J. Muggleton, 14, St. Helens' Place, E.C., clerk; A. E. Bullard, Burleigh, Chudleigh Road, Brockley Grove, S.E., clerk; W. A. Hill, Colwell Road, East Dulwich, S.E., shorthand writer; and A. G. Coggan, 38, Kempe Road, Queen's Park, W., clerk. No initial public issue. The number of directors is not to be more than five; the subscribers are to appoint the first. No qualification required.

Jones & Leslie, Ltd. (86,318).—This company was registered on October 31st, with a capital of £2,000 in £1 shares, to acquire the business of electrical engineers carried on at 26—31, Eyre Street Hill, Hatton Garden, E.C., by T. L. Jones as "Jones & Leslie," and to carry on the same and the business of ironfounders, mechanical engineers, manufacturers of electrical and other machinery, tool makers, &c. The first subscribers (each with one share) are:—F. H. Munby, Crosby Buildings, E.C., solicitor; H. M. Smith, 26, St. John Street, Islington, N., clerk; E. T. Hawkes, 58, Sayer Street, Walworth, S.E., clerk; T. L. Jones, 53a, Franciscan Road, Tooting, S.W., electrical engineer; C. E. Hey, 219, Cromwell Mansions, S.W., barrister; R. G. Campbell, 47, Richmond Gardens, W., writer to the Signet; and H. C. Scott, 10, Woburn Square, W.C., law student. No initial public issue. The first directors are T. L. Jones, W. Jones and J. S. Jones.

Cumberland Power Syndicate, Ltd. (86,364).—This company was registered on November 4th, with a capital of £5,000 in £5 shares, to adopt an agreement with J. Sturgeon, B. H. Thwaite, A. R. Chorley, and J. Paterson, and to carry on in Cumberland and elsewhere the business of an electric power and power gas supply company and that of electricians, electrical and general engineers, gas manufacturers and producers, suppliers of electricity for all purposes, &c. The first subscribers (each with one share) are:—J. H. Green, 14, Gross Belgrave Street, Hartley Hill, Leeds, merchant; J. H. Davies, Warrells Grove, Bramley, Leeds, clerk to Commissioner of Taxes; C. F. Winterhead, 9, Kensington Terrace, Hyde Park, Leeds, clerk; W. F. Potter, 14, Park Row, Leeds, stockbroker; T. Yates, 14, Park Row, Leeds, stockbroker; F. H. Barr, North Grange Road, Headingley, Leeds, gentleman; and J. Kitchen, Springfield Mount, Leeds, dyer. No initial public issue. The number of directors is not to be less than three nor more than seven; the first directors are A. Lupton, W. F. Smith and J. T. Pullen; qualification not stated; remuneration as fixed by the company. Registered office, 4, South Parade, Leeds.

Makin & Co., Ltd. (86,357).—This company was registered on November 3rd, with a capital of £1,000 in £1 shares, to acquire the business carried on at Sheffield as "Makin & Co.," and to carry on the business of electricians, electrical and mechanical engineers, &c. The first subscribers (each with one share) are:—J. Makin, 23 and 25, Division Street, Sheffield, electrical engineer; R. C. Smith, 61, Monmouth Street, Sheffield, clerk; J. King, 72, High Street, Sheffield, hairdresser; G. W. Morris, 61, Monmouth Street, Sheffield, coachman; Mrs. H. Makin, 107, Hanover Street, Sheffield; D. Corrie, 7, Hounsfield Road, Sheffield, plumber; and R. C. Smith, senior, Mill Mount, Luxford, Notts, retired grocer. No initial public issue. Registered without articles of association. The first directors are J. Makin and R. C. Smith, junior. Registered office, 23 and 25, Division Street, Sheffield.

OFFICIAL RETURNS OF ELECTRICAL COMPANIES.

Harvey & Friend, Ltd., electricians, electro-depositors, &c., Birmingham (84,230).—A debenture, dated September 21st, 1905, to secure £100, charged on the whole of the company's property, has been registered. Holder: Miss L. Harvey, Forest Road, Moseley, near Birmingham.

South Metropolitan Electric Light and Power Co., Ltd. (47,875).—Issue, on September 29th, of a debenture for £10,000, part of series created by resolutions of July 3rd, 1900, and May 6th, 1904, to secure a sum not exceeding the amount of the share capital issued and paid up for the time being. Property charged: The company's undertaking and property, present and future, including uncalled capital. The debentures are issued to the trustees for further securing debenture stock created by trust deed of August 3rd, 1900, supplemented by trust deed of June 3rd, 1904. Trustees: H. R. Beeton, 18, Austin Friars, E.C., and W. R. Davies, 10, Moorgate Street, E.C. Previously issued of same series: £200,000.

Fife Electric Power Co., Ltd. (75,736).—This company's annual return was filed on September 27th, when the entire capital of £30,000 in 3,000 shares of £10 each had been taken up and paid for in full. Mortgages and charges: £15,900.

Henley's (South Africa) Telegraph Works, Ltd. (77,781).—This company's annual return was filed on August 11th, when the entire capital of £2,000 in £1 shares had been taken up and paid for in full. Mortgages and charges: Nil.

Electromobile Co., Ltd. (London), (75,139).—A charge, dated August 10th, 1904, securing an indefinite amount, but originally stamped to cover £10,000, was further stamped on October 5th, 1905, to cover an additional £10,000. Property charged: 15 per cent. of all moneys which may be payable to the company under present or future contracts for sale, garage, supply of electricity, or other services in connection with any automobiles, excluding moneys payable exclusively for tire maintenance. Holders: North of England Trustee, Debenture and Assets Corporation, Ltd., 45, Spring Gardens, Manchester.

Harwich Electric Lighting and Tramways Co., Ltd. (66,783).—This company's annual return was filed on August 17th, 1905, when seven shares had been taken up out of a nominal capital of £50,000 in 50,000 shares of £1 each; £1 per share has been called up and £7 remains in arrears. No mortgages or charges.

Halifax and Bermudas Cable Co. Ltd. (28,972).—This company's annual return was filed on October 5th, when the entire capital of £50,000 in 10,000 shares of £5 each had been taken up; £50,000 is considered a paid. Mortgages and charges: £46,500.

Improved Electric Supplies, Ltd. (London), (86,014).—A mortgage debenture dated October 6th, 1905, to secure £4,000, charged on the company's undertaking and property, present and future, including uncalled capital, has been registered. Holder: H. Muff, Red House, Bexley Heath, Kent.

General Electric Co., Ltd. (67,307).—This company's annual return was filed on August 10th, when 25,000 preference and 31,750 ordinary shares had been taken up out of a nominal capital of £800,000 in 40,000 preference and 40,000 ordinary shares of £10 each. £10 per share has been called up on 18,000 preference and 6,750 ordinary shares, resulting in the receipt of £247,500. £320,000 is considered as paid on 7,000 preference and 25,000 ordinary. Mortgages and charges: £200,000.

Yale Electric Power Co., Ltd. (60,493).—This company's annual return was filed on October 7th, when 629 shares had been taken up out of a nominal capital of £20,000 in 800 shares of £25 each. £25 per share has been called up on 561, and £13,780 has been received, leaving £245 in arrears. £1,700 is considered as paid on 68 shares. Mortgages and charges: Nil.

Vaughan & Son, Ltd. (61,526).—This company's annual return was filed on October 12th, when 3,595 preference and 20,689 ordinary shares had been taken up out of a nominal capital of £50,000 in 20,000 preference and 30,000 ordinary shares of £1 each. £1 per share has been called up, resulting in the receipt of £24,284. Mortgages and charges: £5,000.

New Phonopore Telephone Co., Ltd. (44,654).—A list of allotments made up to October 9th, 1905, shows a further 100 ordinary shares taken up (10s. called up on each) in addition to the 5,111 ordinary and 1,000 founders' shares shown by the return of October 7th, 1904, to have been issued (10s. per share being called up and paid on the ordinary and £1 per share considered as paid on the founders'), out of a nominal capital of £10,000 in 9,000 ordinary and 1,000 founders' shares of £1 each. Mortgages and charges: Nil.

Mather & Platt, Ltd. (60,387).—This company's annual return was filed on October 5th, when 40,000 preference and 40,000 ordinary shares had been taken up out of a nominal capital of £1,000,000 in 50,000 preference and 50,000 ordinary shares of £10 each. £10 per share has been called up on 29,200 preference and 2,500 ordinary shares, resulting in the receipt of £317,000. £483,000 is considered as paid on 10,800 preference and 37,500 ordinary. Mortgages and charges: Nil.

Electromobile Co., Ltd. (75,139).—A memorandum of satisfaction, to the extent of £10,000, of a mortgage dated August 10th, 1904, securing £3,500 and further advances of an indefinite amount (now stamped to cover up to £20,000), has been filed.

Improved Electric Supplies, Ltd. (London), (86,014).—£2,500 second mortgage debentures, created October 4th and dated October 13th, 1905, charged on the company's undertaking and property, present and future, including uncalled capital, have been registered. No trustees. Holder: W. Chamberlain, Pendock Grove, Cobham.

Electric Conversion Syndicate, Ltd. (76,877).—An equitable charge, dated October 13th, 1905, to secure £16,500 has been registered. Property charged: Uncalled capital to the extent of 7s. 6d. per share on 32,350 £1 preference shares in this syndicate, £47,500 first mortgage debenture stock of the South Lancashire Electric Traction and Power Co., Ltd.; 20,638 £1 fully-paid preference shares in the Sunderland District Electric Tramways, Ltd.; 18,441 £1 ordinary shares in the Durham Collieries Electric Power Co., Ltd. 1,585 £5 preference shares in the North Wales Power and Traction Co., Ltd. and 14,500 £1 shares in the Canadian Electric Traction Co., Ltd. Holders Messrs. Herbert Wagg & Russell, Southsea House, E.C.

Electric Safety Appliances Co., Ltd. (London) (83,864).—A mortgage debenture dated October 11th, 1905, to secure £100, charged on the company's undertaking and property, present and future, has been registered. Holder: R. J. Bott, 235, Phillip Lane, Tottenham.

ELECTRICITY SUPPLY ACCOUNTS.

Manchester Municipal Electricity Supply.

The work of the Manchester Electricity Department moves on apace, and its 50 million units (approximate) output and sales of 33,686,710 units represent sound progress, which must be gratifying alike to the department and its rather too sanguine sponsors. The revenue shows an increase of some £35,000 over that of 1904, earned by an additional £7,000 working expenditure; the lamp connections equalled some 458,000 8-c.p., and the motors connected will, ere this, have reached 10,000 h.p.

On the other hand, the department's heavy liabilities in respect of only partly productive plant, must handicap the undertaking as a profit-making concern for some years to come. Hence, it is satisfactory to find that after meeting financial charges, some £17,000 in excess of last year's, it was possible to place some £38,000 towards renewals, and to carry to reserve £4,544, as compared with £25,000 for renewals, and £6,809 carried to reserve in 1904.

The prices charged are:—Private lighting, 5½d.* and 1¾d. per unit, maximum demand system; power, 1¾d. — 1d. per unit, sliding scale; traction, 1·49d., and public lighting 2d. per unit. The chief engineer is Mr. S. L. Pearce.

* Since reduced to 4½d.

General Statement.

For year ending March 31st	1905.	1904.
Total capital expended	£2,199,689	£2,110,432
Number of units sold—		
Private supply	14,679,373	11,799,214
Public lighting	81,032	41,553
Traction	18,926,305	17,125,857
Total number of units sold	33,686,710	28,966,624
Equivalent No. of 8-c.p. lamps connected	458,442	415,000
h.p. of motors connected	9,395	6,142
Number of public lamps	53	29
Maximum load in kw.	20,023	17,290
Revenue account—		
Gross revenue	£302,200	£267,788
„ expenditure	£135,992	£129,308
„ profit	£166,208	£138,480
Average price obtained per unit—		
Private supply	2·99d.	3·26d.
Public lighting	2·00d.	2·00d.
Traction	1·50d.	1·50d.

Revenue Account for Year ending March 31st, 1905.

Gross revenue	£302,200	=	2·16d. per unit.
Works and distribution costs	£105,702	=	·75d. „
Total working costs	£135,992	=	·97d. „

Profit Statement, 1905.

Interest on loans	£64,144
Sinking fund and repayment of loans	59,192
Balance carried forward to reserve	4,544
Special renewals	13,328
Renewals suspense account	25,000
Gross profit	£166,208

CITY NOTES.

Western Union Telegraph Co.

The annual report to June 30th, 1905, has just been published, and we give the following extracts therefrom. Revenues amounted to $29,033,635 being a decrease of $215,755, as compared with the previous year, whereas the expenses showed an increase of $483,654, as compared with the same period. Part of the increased expenditure was caused by the reconstruction of the lines, this cost being the largest in the history of the company. The number of poles per mile were increased on the main routes, and copper wires were substituted for iron ones. In other branches there was a small decrease of expenses. The net revenue for the year was $7,188,064, and of this $4,868,083 was paid in dividends, and $1,227,200 in interest on bonds, leaving $1,092,780 to add to the surplus. The net growth of the plant, was in poles and cable, 874 miles; in wires, 29,152 miles; in offices, 356. Of the total of 1,184,557 miles of wire at the close of the year, 306,736 were of copper. The cost of new construction was $1,177,500, this being less than last year by $1,288,279. Contracts were also made with various railway companies during the year, owning 3,474 miles of line. Total expenses amounted to $21,845,570.

British Thomson-Houston Co.

The tenth ordinary general meeting of the above company was held on Wednesday at the offices, 83, Cannon Street, E.C., Mr. G. Franklin presiding.

The Chairman said that the printed accounts and report were sufficiently explanatory. The position of the company only went to show that they had had a longer rope to hold at Rugby than than they had any idea of, and the difficulties which arose in connection with the manufacture there had since become manifest by reason of the severe home and foreign competition they had had to contend with. That made their difficulties sufficient to require constant attention on the part of the board. There was one item on which a shareholder wanted information, and that was as to why it was that the charge for interest on loans had increased from £9,047 last year to £20,601 this year—an increase of £11,600. It was entirely due to the fact that last year the General Electric Co. had a large claim against the company as an ordinary trade creditor, and that sum had now commenced to carry interest at the rate of 3 per cent. The directors, however, could give the shareholders the assurance that the company's financial position was satisfactory. Last year their securities stood in the balance-sheet at £518,302, and the directors had been able since to dispose of £350,000 at par, and so reduce the liabilities on the other side by that amount. Whatever happened, therefore, the security and position of the company was not in danger. He moved the adoption of the report.

Mr. J. F. Nauheim seconded the motion, and the report was adopted.

The retiring directors and auditors were re-elected, and the meeting closed.

Electrolytic Alkali Co.

We read in the *Financial Times* (from which we make the following extracts) that the annual meeting was held in Liverpool on Tuesday.

Mr. C. C. Connor (the chairman) said that since the report had been issued, Mr. James Hargreaves, a member of the board, had sent out a circular to a large number of shareholders. His attitude in doing so they were at a loss to understand, as his circular only exhibited his difference of opinion from the rest of the directors. Mr. Hargreaves had given notice that he would at that meeting ask first why the warnings and information given in his protest and letter of advice had not been heeded; secondly, as to the acquirement of patents for improvements in electrolysis and auxiliary processes; and, thirdly, as to the valuation of the company's plant. In reply to the first question, the chairman said it was incorrect to suggest that any advice Mr. Hargreaves had given, or suggestions he had made, had not received due consideration. They had acquired all the patents for improvements in processes submitted to them which they considered valuable. The company's plant stood in the books at cost, less depreciation, and the majority of the board, as well as the company's auditors, were satisfied that the published figures were correct. The company had suffered from influences altogether uncontrollable by the directors, and bearing that in mind, they considered the report was encouraging, and one with which they hoped the shareholders might be pleased. The net trading profit exhibited a marked improvement, being about £4,200 against £500 last year. They trusted that the results warranted the anticipation that they had at length reached the turning point, and there might be still better results in the future.

Mr. Hargreaves opposed the adoption of the report in a long speech, in which he contended that all he had stated in his letter of protest had been justified. When the balance-sheet was brought forward he refused to sign it because he had not seen the accounts, and when he began to examine the books he was told that he had exceeded his powers. He maintained that certain salt plant which the company possessed was not adapted to their circumstances.

The motion was carried.

A long discussion ensued upon a motion to elect Mr. G. H. Harrison a director. Mr. Hargreaves said if Mr. Harrison were elected they might accept his resignation as a director.

A poll resulted in the election of Mr. Harrison by 112,891 votes to 23,771 given for Mr. Owen.

Eastern Extension, Australasia and China Telegraph Co.

The sixty-fourth half-yearly ordinary general meeting was held on Wednesday last week at River Plate House, Sir J. Wolfe Barry, the chairman, presiding. In proposing the adoption of the report (which was agreed to), the Chairman said he thought the shareholders would agree with him in regarding the result of the half-year as fairly satisfactory. The gross revenue for the six months had amounted to £349,000 against £300,000 for the corresponding period of 1904, an increase of £49,000. That result was not entirely due to growth of traffic. A portion, some £19,000, of the increase consisted of revenue that was earned in 1904, but not included in that year's accounts owing to unavoidable delay in adjusting accounts with other telegraph companies, and consequently the increase during the past half-year, actually due to growth of traffic, was about £30,000. A portion of this increase was undoubtedly attributable to the war in the Far East, but as the bulk of it was spread over the company's whole system, with the exception of the Australasian, where a small decrease was experienced, they might draw the encouraging conclusion that a considerable portion of the increase was due to general growth of business. Since the conclusion of peace between Russia and Japan a falling off had been noticeable in the China and Japan traffic; but, on the other hand, he was glad to say the traffic with Australasia had shown some improvement during the last few months, and they might hope that growth of business with China and Japan, when relieved of the incubus of war, would equal the abnormal growth due to the late exhausting hostilities. The working and other expenses had amounted to £136,000 against £142,000 for the corresponding period of 1904, showing a decrease of £6,000. Although station salaries showed an increase of nearly £5,000, due

mainly to a larger staff having been engaged in order to efficiently deal with the increased traffic, there had been reductions in many other items of expenditure, notably in the cost of maintenance of cables, which alone accounted for £4,000 of the decrease. That arose from their having had an exceptionally small number of cable interruptions during the passed half-year, and to the fact that they had occurred in their shallow water sections, which represented a considerable proportion of their extensive cable system. The comparative immunity from cable interruptions might largely be attributed to the extensive renewal work which they had carried out from time to time whenever the old cables had shown signs of serious deterioration. However that might be, cable repairs had been, comparatively speaking, light during the period under consideration, and it would not be prudent to look upon the present as necessarily an index of the future. The tariff for telegrams between Europe and Japan by this company's route was reduced from July 1st last from 5s. 8d. to 4s. 10d. per word, making it the same as by the Great Northern Co.'s route *via* Russia.

Western Telegraph Co.

The sixty-fourth ordinary general meeting was held on Wednesday last week at River Plate House, Sir J. Wolfe Barry in the chair.

The Chairman, in proposing the adoption of the report (see Electrical Review, October 27th), said it afforded him great pleasure to call attention to a continuance of the prosperous condition of affairs in South America, and a consequent satisfactory improvement in the company's revenue. The message receipts for the half-year ended June 30th last amounted to £253,000 as against £216,000 for the corresponding period last year, being an increase of between £37,000 and £38,000. It was gratifying to observe that that improvement was being maintained, but still they must be prepared for times of depression and slackness in trade, which appeared to be inevitable sooner or later to every country. A large proportion of the extra working cost was accounted for by the enhanced value of the Brazilian currency. The gross increase in the expenses amounted to £5,261. The amount spent on repairs to cables had been very heavy compared with the corresponding period, and maintenance of cables showed the large increase of £16,207. The largest item was the value of the submarine cable used in repairs, which represented the sum of nearly £20,000, and exceeded the expenditure of the corresponding period by £12,212. The net result of the half-year was an increase of £41,379 in the revenue from all sources, and an increase in the working expenses of £17,118. Since the last meeting they had had a change of members of the board, Mr. Andrews having felt it necessary to resign his directorship on account of ill-health. He had been connected with the company for 28 years, during the greater part of which he acted as chairman. They all owed him great obligations, and all regretted his resignation. They had been very fortunate in having been able to elect Lord Balfour of Burleigh to fill Mr. Andrews's seat on the board. He had received a communication from a proprietor, stating his opinion that a larger dividend should be paid, and he had also seen observations in some newspapers to the same effect. He wished, however, to remind the shareholders that their main line deep-sea cables were laid many years ago—in one case over 30 years and in the other over 20 years—and although when interruptions had occurred they had thus far been able to repair the cables, they must and ought to be prepared for the time when that would no longer be possible. Such an operation would necessitate the expenditure of several hundred thousand pounds, and he was sure the majority of the shareholders would see the advantage of the policy of the board in building up the reserve fund to enable them to meet such contingencies, and of judiciously conserving their resources to ensure as far as possible a continuance of the very handsome dividend of 7 per cent.

Sir J. Denison-Pender seconded the motion, which was adopted after a short discussion.

Richardsons, Westgarth & Co.

At the annual meeting held at Hartlepool last week Sir Christopher Furness, M.P. (chairman), said that the past year had been one of very severe depression and exceptionally keen competition in the engineering trade, particularly in marine engineering, and taking this into consideration, the results set forth in the balance-sheet were satisfactory. This was largely due to the fact that although marine engines and boilers formed their principle manufacture, yet at each of their works they had, in addition, a range of specialities that contributed very materially to their business. Their new steam turbine works were completed and in full operation, being well supplied with work. They had obtained excellent results from their condensing plants, and particularly from the "Contraflo" condenser, for which they had a large number of orders. At Middlesbrough the development of their gas engine business had been both continuous and satisfactory. The "Nesdrum" water-tube boiler was also being manufactured there, and the results obtained confirmed his opinion that it was a very simple and highly efficient steam generator. The extensions to their various works during the year had been considerable. At Sunderland the boiler-shop had been enlarged and fitted with electric cranes and other modern appliances. With regard to prospects they had at present a larger order book than a year ago, and, as trade was distinctly improving, they were hoping for more remunerative prices than had prevailed during the recent depression.

A dividend on the ordinary shares for the year ended August 25th, 1905, at 6 per cent. was declared.

Drake & Gorham, Ltd.

The directors' report for the year ended June 30th, 1905, states that after payment of all charges, including bonuses due to staff, there remains a net profit of £10,822, which, with the sum of £1,722 brought forward from the previous year, makes a total of £12,544, which it is proposed to appropriate by payment of a dividend at the rate of 6 per cent. per annum, £7,500; by placing to reserve £3,000, and by carrying forward £2,044; = £12,544. The reserve fund will then stand at £12,000. The directors regard the increase of £2,173 in the net profit as satisfactory, for during the period under review there has been little improvement in the general condition of electrical business.

The Church Stretton Supply Station has been started and has worked efficiently from the commencement. In addition to Goodwood, which has been completed, the company are engaged in lighting the village of Fochabers for his Grace the Duke of Richmond and Gordon from the water power generating station which is already supplying the light to Gordon Castle. The company have been entrusted with the electrical equipment of a cotton mill in Lancashire, in which steam plant and generators of the latest type will be employed, the power amounting to upwards of 1,000 H.P. being transmitted electrically. It is anticipated that this work which has been throughout designed by the company's staff will lead to important developments in the future. At the Electrical Exhibition, held at Olympia, the company showed the salient features of their system, and it is hoped that a considerable amount of work will result from the inquiries received. A large number of installations have been carried out during the year, and the work in hand on June 30th was greater than at the corresponding period of the previous year. Negotiations are in progress for the acquisition on lease of further premises for factory purposes, the present arrangements affording insufficient facilities for the manufacturing department of the business.

The meeting is to be held on November 16th, and an extraordinary general meeting is to follow for approving a proposed slight alteration in the articles.

Buenos Ayres Grand National Tramways Co.

The report for the year ended March, 1905, says that in view of the improvement in the company's position expected from the electrical operation of its lines, the directors have felt the urgent necessity of dealing with the capital and revenue accounts so as to enable the shareholders to reap the benefit of the improvement without undue delay. They have decided to proceed by a Bill in Parliament for the reorganisation of the company's capital and revenue accounts upon a basis the details of which will in due course be submitted to all the various security holders for their approval, and it is proposed to deposit a Bill with this object in the course of November.

At the meeting of the company held on 3rd inst. Mr. J. Irving Courtenay made a statement—the result of recent personal observations in Buenos Ayres—regarding the work of electrification. They intended to make every effort to proceed continuously with this work and carry it on to completion. Up to October 31st 32½ miles had been converted, and the sections open to the public covered a distance of 24 miles. The results already obtained amply justified the policy of electrification.

Prospectus.

W. T. Henley's Telegraph Works Co., Ltd.—This company is making an issue of £150,000 4½ per cent. first mortgage debenture stock, and is offering for subscription £108,022 of the stock at par. The holders of the existing debenture stock are to be paid off at a premium of 10 per cent., and £41,798, part of the present issue, is to be allotted to them, the residue being paid in cash. Our readers are aware that the company is engaged in building a new factory at Gravesend. Further particulars appear in the abridged prospectus published in our advertisement pages.

Castner-Kellner Alkali Co.—The directors have declared an interim dividend for the six months ended September 30th at the rate of 4 per cent. per annum.

Amazon Telegraph Co.—The accounts for the year ended June 30th show a net profit, after providing for interest charges and the service of the debentures, of £9,836, reducing the debit balance brought forward to £78,235.

Montreal Light, Heat and Power Co. — The directors have declared a dividend at the rate of 4 per cent. per annum for the three months ended October 31st last.

Stock Exchange Notices.—The Committee has appointed a special settling day as under:—

Wednesday, November 22nd.—Johnson & Phillips, Ltd.—6,635 ordinary shares of £1 each, fully paid, Nos. 1 to 6,635; and £116,667 5 per cent. first mortgage debenture stock.

The Committee has also ordered the undermentioned to be quoted in the Official List:—

Indian Electric Supply and Traction Co., Ltd.—Partly paid provisional certificates for £120,500 6 per cent. construction debenture stock.

Bordeaux Electric Tramways and Omnibus Co.—A dividend for the half-year ended June 30th, 1905, will become payable on November 15th as follows:—4·80 fr. on registered shares, 4·59 fr. on bearer shares.

West India and Panama Telegraph Co. — The directors recommend a dividend of 6s. per share on account of arrears of dividend on the first preference shares.

ELECTRIC TRAMWAY AND RAILWAY TRAFFIC RETURNS.

Locality.	Fortnight ended.	Receipts for the fortnight. £	* £*	No. of wks.	Total to date. £	* £*	Route miles open.	*
Aberdeen	Nov. 4	2,468	+ 80	23	34,173	— 1,566	..	..
†Ayr	Oct. 28	178	— 8	23	8,925	— 117	8	..
Bath	Nov. 1	1,284	+ 51	44	30,365	+ 1,813	13	..
Birkenhead	,, 5	1,913	— 68	31	33,035	— 697	13·5	..
Blackburn	,, 1	1,807	+ 41	31½	31,726	+ 1,003	14·25	..
Blackpool Corp.	,, 2	744	— 41	31	42,955	+ 1,865	11·87	..
,, —Fleetw'd	,, 4	490	— 182	18	18,860	— 1,014	..	..
,, —Lytham	June 22	1,602	+ 753	34	7,608	..	7½	..
Bolton	Nov. 5	3,629	+ 253	32	62,232	+ 2,287	26	+ 1
Bournemouth	,, 1	2,676	+ 850	30½	45,119	+ 8,116	17·4	+ 7½
Bradford	,, 4	8,126	— 318	31	139,867	— 7,524	53	..
Brighton	,, 5	1,586	— 151	32	34,504	..	9·5	..
Bristol	,, 3	9,208	— 284	..	..	..	28·5	..
Brit. Elec. Trac. Co.								
Airdrie	Oct. 27	415	— 12	43	8,843	+ 121	8·5	..
Barnsley	,, 27	307	— 19	,,	6,352	— 314	3	..
Barrow	,, 27	409	+ 9	,,	10,525	+ 2,122	5·37	..
‡Birmingham (City)	,, 27	10,028	— 923	,,	231,852	+ 1,103	14·5	..
Birmingham (Mid.)	,, 27	2,705	— 354	,,	68,953	+ 395	12·25	..
Devonport	,, 27	838	— 173	,,	20,042	— 3,052	8·85	..
Dudley—Sto'rb'ge	,, 27	1,590	— 56	,,	39,046	+ 1,326	21·25	..
Gateshead	,, 27	1,850	+ 22	,,	33,656	+ 722	11·25	..
Gravesend, N'fleet	,, 27	401	— 33	,,	10,101	— 953	6·5	..
Gr'n'k, Pt. Glsgw	,, 27	1,235	+ 121	,,	27,993	+ 3,039	7·25	..
Hartlepool	,, 27	482	— 46	,,	11,593	— 1,197	6·72	..
Kidderminster	,, 27	186	— 26	,,	5,850	— 311	4·5	..
Leamington	,, 27	318	+ 62	15	5,140	+ 1,192	..	..
Merthyr	,, 27	356	— 22	43	8,213	— 454	2·9	..
‡Metropolitan	,, 27	5,260	+1,063	,,	115,455	+10,340	..	..
Middleton	,, 27	586	— 9	,,	14,806	+ 602	8·5	..
Oldham — Ashton	,, 27	1,107	+ 29	,,	24,090	+ 456	9·13	..
Peterborough	,, 27	197	— 56	,,	5,993	— 622	5·31	..
Potteries	,, 27	3,546	— 26	,,	73,256	+ 463	29	..
Rothesay	,, 27	103	+ 16	,,	9,298	+ 2,648	2·75	..
Sheerness	,, 25	110	— 6	,,	3,094	+ 299	2·5	..
Southport	,, 27	467	— 65	,,	13,813	— 498	8·17	..
South Staffs.	,, 27	1,623	+ 214	,,	31,609	+ 1,030	13·87	..
Swansea	,, 27	1,488	+ 471	,,	31,020	+ 7,514	5·5	..
†Taunton	Sep. 8	57	— 3	36	1,851	— 191	1·5	..
Tynemouth	Oct. 27	376	— 29	43	11,535	— 1,555	3·75	..
Weston-s-Mare	,, 25	88	— 16	,,	6,613	+ 614	3	..
Wolverhampton D.	,, 27	796	+ 18	,,	17,117	+ 171	14·75	..
‡Worcester	,, 27	440	— 83	,,	13,314	+ 484	5·75	..
Wrexham	,, 27	183	— 14	,,	4,396	— 388	4	..
Yorks. Wool. Dist.	,, 27	1,298	+ 269	,,	28,280	+ 2,897	17	..
Burnley	Nov. 4	2,173	+ 175	..	..	..	7·5	..
Burton-on Trent	,, 5	557	— 57	31	10,135	— 1,290	8·5	..
Bury	Oct. 29	1,398	..	30	22,647	..	10·5	..
Cardiff	,, 28	3,642	— 179	30	63,960	+ 141	15·8	..
Carlisle	Nov. 4	324	— 17	44	8,188	— 548	..	..
Chatham and Dist.	,, 2	1,146	+ 54	44	29,291	+ 3,090	9·3	+ ·8
Colchester	,, 1	296	— 108	14	3,036	..	7	..
Cork	,, 2	819	— 89	44	21,567	+ 675	9·9	..
Darlington	,, 4	412	+ 59	31	6,471	..	4·87	..
Darwen	,, 4	477	+ 35	31	7,690	+ 370	4·36	..
†Dover	Oct. 21	205	+ 7	42	9,258	— 157	3·5	..
Dublin	Nov. 3	9,103	— 71	..	94,256	— 951	48·5	+ 1·5
Dundee	,, 1	1,814	+ 177	24	22,323	+ 1,109	12·5	..
East Ham	,, 6	1,475	+ 211	31	26,412	+ 2,767	6·75	..
Glasgow	,, 4	90,463	+1,314	22	347,659	+17,113	76	+ 3·5
Gloucester	,, 1	482	— 16	32	9,769	..	9	..
Halifax	Oct. 25	1,465	+ 95	29	49,683	+ 2,583	37	+ 2·5
Huddersfield	Nov. 4	2,648	+ 253	32	43,004	+ 1,372	28	..
Hull	,, 4	4,278	— 29	31	69,809	+ 544	13	..
†Ilford	Oct. 28	385	+ 2	31	15,075	+ 224	..	..
Ilkeston	Nov. 1	246	— 34	31	3,812	— 796	3·5	..
Ipswich	,, 4	688	— 96	31	14,497	— 1,798	10·5	..
Isle of Thanet	,, 4	564	— 111	44	29,638	— 3,206	..	..
Kirkcaldy	,, 1	380	— 19	..	..	..	7·5	..
Lan'kshire Trm. Co.	,, 2	1,785	+ 246	44	32,796	+ 3,927	12·5	+ 3·9
†Leeds	Oct. 28	5,618	+ 198	30	186,382	+ 3,719	89·5	+ 8
†Leicester	Nov. 4	1,972	+ 293	44	91,761	+28,676	..	..
Liverpool	Oct. 28	20,332	— 282	43	455,912	+ 8,663	104	+ 1
L.C.C.	,, 21	28,692	+2,159	29	441,526	+64,391	51¼	+ 4⅝
Lowestoft	Nov. 4	316	+ 6	5	832	— 31	3·5	..
Manchester	,, 4	22,066	+ 978	31	406,225	+15,415	..	..
†Newcastle	Oct. 28	4,149	+ 524	30	116,391	+ 3,347	..	..
Newport	Nov. 4	1,079	+ 132	5	2,704	+ 268	14·5	+ 1·5
Oldham	,, 5	3,193	+ 801	32	53,099	+14,249	23·75	+ 3¾
Plymouth	..	..	..	..	..	..	..	..
Pontypridd	,, 4	283	..	31	5,201	..	3·5	..
Portsmouth	,, 4	2,977	— 59	31	67,278	+ 1,123	14·5	..
†Preston	,, 1	601	..	..	..	..	..	..
†Reading	Oct. 26	545	— 78	50	19,589	— 858	..	..
Rochdale	Nov. 4	1,566	+ 834	31	24,440	+17,955	21·3	+ 8
Salford	Oct. 30	8,067	— 66	31	133,842	+ 6,618	..	..
Scarborough	,, 21	129	..	42	7,474	..	4·5	..
Sheffield	Nov. 5	9,423	+ 395	32	158,631	+ 7,071	35·75	-1·5
Southampton	,, 1	1,740	— 44	4½	4,026	— 437	..	..
Southend-on-Sea	July 26	1,089	+ 67	17	6,596	+ 468	6·25	..
Stalyb'dge, Hyde, &c.	Oct. 28	1,197	+ 349	30	19,915	..	21	..
Stockport	,, 27	1,507	+ 407	30	23,110	+ 4,800	15·5	+ 4
Sunderland	Nov. 5	2,414	+ 172	31	42,417	+ 1,152	..	..
Swindon	Oct. 18	361	..	29	5,989	..	4·4	..
Tyneside	Nov. 1	840	+ 144	44	18,417	+ 1,027	8·87	..
Warrington	,, 2	667	+ 35	31	10,656	+ 525	6·37	+ ·25
West Ham	,, 2	3,744	+1,590	31	55,987	+23,473	13·25	+ 3·4
Wolverhampton	,, 1	1,514	..	..	..	..	10	..
Cen. London Rly.	Nov. 4	13,903	+ 294	18	109,651	— 1,208	6	..
City & S. Lon. Rly.	,, 5	5,776	+ 357	18	44,389	— 71	6·25	..
Dublin-Lucan Rly.	,, 3	193	— 18	18	2,453	— 12	7	..
G. N. and City Rly.	,, 4	3,340	+ 533	18	27,018	+ 6,478	3·5	..
L'pool Overh'd Rly.	,, 5	2,709	— 300	14	29,301	— 1,272	6·67	..
Mersey Railway	,, 4	3,184	+ 144	18	28,115	+ 1,714	4·5	..

* Compared with the corresponding period of 1904. † One week only.
‡ Includes horse and other receipts.

STOCKS AND SHARES.

Wednesday evening.

Dear money and Russian disquietude are the two most prominent factors in the general markets this week. The money situation shows faint signs of becoming easier, despite the rise in the Berlin bank rate, and if it does, this will make a considerable difference to the sentiment of the investor with regard to better-class securities. Whereas there was an avid desire to buy good Debenture stocks only a couple of months ago, the desire has slackened considerably of late, and, of course, this affects the share prices too.

Electricity Supply issues are dull. There are but three rises to record in the list, and nine falls. By the irony of circumstances, one of the rises is in Westminster Electric Ordinary, which really started the fall in the supply market a fortnight ago, when the proposals affecting the Preference shares were first mooted. The various suggestions for new power Bills now being put forward by the London County Council and other bodies are unsettling to the mind of the average holder, while, in addition to the other cares that have fallen upon the market, several extensive selling orders for large lines of shares have been executed. It is needless to catalogue the series of declines which have occurred; they range in extent from $\frac{1}{32}$ in Edmundson's Preference to 10s. in Charing Cross Ordinary and St. James' Ordinary shares.

Seeing how much the Westminster Corporation's proposals, already mentioned, have attracted general interest, it is as well to see how Electric Lighting Preference shares stand with regard to the return which can be obtained from a purchase at present market levels. In the following table, the calculations are based upon the middle quotations now ruling, and a final column is given to show when the dividends on the shares are payable:—

Company.	Pref. divd.	Price.	Yield on money.	Divs. paid.
Brompton & Kensington	7	9½	£3 13 8	Feb.-Aug.
Charing Cross	4½	5⅞	4 1 10	Feb.-Aug.
,, "City"	4½	4¾	4 12 4	June-Dec.
City of London	6	14	4 5 9	Mar.-July
County of London	6	12⅝	4 15 1	Feb.-Aug.
Edmundson's	6	6⅛	4 18 9	May-Nov.
London Electric	6	5⅛	5 17 1	Mar.-Sept.
Metropolitan	4½	5⅝	3 18 3	Jan.-July
St. James's	7	9	3 18 10	Feb.-Aug.
Urban	5	5⅛	4 17 7	April-Oct.
Westminster	5	6¼	4 0 0	June-Dec.

From the above, it is manifest that with a little judicious selection an investor may obtain 4¼ to 4½ per cent. on his money, with excellent securities that have good prospects of improving in capital value when the general financial position becomes more stable.

Some of the Electrical Railway stocks have hardened a little, Central London Ordinary, for example, rising a point to 93, and Great Northern and City Preferred shares ¼, to 5½. There exists a fair demand for Great Northern, Piccadilly and Brompton Scrip certificates at about 75½, the fraction representing the premium on the issue price. Metropolitan declined to 91½, but Districts put on 1 at 39. City and South London remains stationary, while Waterloo and City lost a point at 88, for which the state of the Money Market is the chief reason.

Traction descriptions are firmer on balance, British Electric Ordinary having ⅛ advance at 10, Potteries Preference ¼ at 9½, and the Debenture stock 2 per cent. at 104. The Argentine group is steady; Buenos Ayres Grand National Preference are distinctly firmer at 7⅞. British Columbia Deferred and Preferred have risen a point each, and Calcutta Trams are ¼ better. Slight offering of British Westinghouse Preference put back the price to 2 7/16 middle, and buyers are coy of appearing. Several of the manufacturing shares continue in demand, and Dick, Kerrs score ⅛ rise at 8⅞. On the other hand, Telegraph Constructions dropped half a sovereign to 34.

Two rises of 15s. stand out as the features of the Telegraph market. One is in Amazon shares, now at 4¼, and the other in Direct United States at 14. The latter is due to a rumour that the company may cease adding to reserve when the fund reaches half a million sterling, and give more dividend to the shares. Eastern Extensions added ¼ at 14⅜—the only movement in the Eastern group. The Anglo-American trio has nothing of importance to mention, and in the Western issues West India and Panama Second Preference are ¼ lower at 7½. Indo-Europeans recovered their recession of last week.

National Telephone Preferred and Deferred are each ½ down, but at 5½ United River Plate Telephone Preference are 2s. 6d. better.

SHARE LIST OF ELECTRICAL COMPANIES.

TELEGRAPH AND TELEPHONE COMPANIES.

Present Issue.	NAME.	Stock or Share. ‡	Dividends for the last four years. 1902.	1903.	1904.	1905. §	Closing Quotations Nov. 1st.	Closing Quotations Nov. 8th.	Business done week ended Nov. 8th, 1905. Highest	Lowest.	Rise + or Fall —
34,800	African Direct Telegraph, 4 % Debs...	100	4 %	4 %	4 %	..	99 –102	99 –102	..	..	..
25,000	Amazon Telegraph Co.'s shares, Nos. 1 to 25,000	10	Nil	Nil	Nil	..	3¼— 3⅜	4 — 4⅛	4 1/16	3 15/16	+ 3/16
119,700‡	Do. do. 5 % Debs., Nos. 1 to 1,250 Red.	100	Nil	Nil	Nil	..	82 — 87	83 — 88	85¼	..	+1
763,580	Anglo-American Telegraph	Stock	60/6	61s.	2½%	29s. §	60 — 62	60 — 62	60⅜	60	..
3,118,210	Do. do. do. 6 % Pref.	Stock	6 %	6 %	5½%	58s. §	107⅛–108⅛	107⅛–108⅛	108 1/16	107 15/16	..
3,118,210	Do. do. do. Deferred	Stock	1/-	2s.	Nil	..	15⅝— 15¾	16⅛— 16⅜	16 1/16	15⅝	+ ⅛
44,000	Chili Telephone, Nos. 1 to 44,000	5	6 %	7 %	8 %	..	7⅞— 7¾	7⅞— 7¾	..	..	..
1,932,856‡	Commercial Cable Stlng. 500 year 4 % Deb. Sk. Red.	Stock	4 %	4 %	4 %	..	97 — 99	96 — 98	99	97	–1
16,000	Cuba Telegraph	10	6¼%	10 %	5 %	5 %§	8⅞— 9¼xd	8⅞— 9¼	9 1/32	..	..
6,000	Do. 10 % Pref.	10	10 %	5 %	10 %	10 %§	17 — 18 xd	17 — 18	..	..	..
12,931	Direct Spanish Telegraph, Ord.	5	4 %	4 %	4 %	4 %§	3⅜— 3⅝	3⅜— 3⅝	..	..	..
6,000	Do. do. 10 % Cum. Pref.	5	10 %	10 %	10 %	10 %§	9¼— 9½	9¼— 9½	..	..	..
30,000	Do. do. 4½ % Debs.	50	4½%	4½%	4½%	4½%§	100 –103	100 –103 %	..	..	..
60,710‡	Direct United States Cable	20	3⅛%	3 %	3½%	3 %§	13 — 13⅛	13¼— 14⅛	14⅛	13½	+ ⅜
74,500	Direct W. India Cable, 4½ % Reg. Deb., 1 to 1,200,R.	100	4½%	4½%	4½%	..	100 –102	100 –102	..	..	..
4,000,000	Eastern Telegraph, Ord. Stock	Stock	7 %	7 %	7 %	5 %§	143 –146	143 –146	146	144½	..
2,000,000	Do. 3½ % Pref. Stock	100	3½%	3½%	3½%	3½%§	89 — 91	89 — 91	90½	89	..
1,836,814	Do. 4 % Mort. Deb. Stock Red.	Stock	4 %	4 %	4 %	4 %§	106 –108 xd	106 –108	107⅜	..	..
300,000	Eastern Extension, Australiasia, and China Tele.	10	7 %	7 %	7 %	6 %§	14½— 14⅝	14½— 15	14 15/16	14 7/16	+ ⅛
602,400	Do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	4 %§	106 –108	106 –108	107½	107¼	..
300,000	East & S. Afric. Tel., 4 % Mt. Db., 1 to 3,000, red. 1909	100	4 %	4 %	4 %	..	99½–101½	99½–101½	99½	..	..
200,000‡	Do. 4 % Reg. M. Debs. (Mauritius Sub.) 1 to 8,000	25	4 %	4 %	4 %	..	101¼–103⅛	99½–101¼xd	..	..	..
180,887	Globe Telegraph and Trust	10	£3	5½%	5½%	..	10⅝— 10¾xd	10⅝— 10¾	10⅝	10 3/16	..
180,887	Do. do. 6 % Pref.	10	6 %	6 %	6 %	..	14¼— 14⅜xd	14¼— 14⅜	14⅜	14⅛	..
150,000	Great Northern Telegraph, of Copenhagen	10	12½%	15 %	24 %	..	35½— 36½	35½— 36½	35⅝	..	..
46,500	Halifax and Bermudas Cable, 4½ % 1st Mort. Debs., within Nos. 1 to 1,200, Red.	100	4½%	4½%	4½%	..	100 –102	100 –102	..	..	..
17,000	Indo-European Telegraph	25	10 %	10 %	13 %	..	54½— 56¼xd	55 — 57	56½	55	+ ½
72,680	Monte Video Telephone Co., Ltd. Ord.	1	3 %	3 %	4 %	..	1 5/16— 1 7/16xd	1 3/16— 1 5/16	..	..	..
1,983,333	National Telephone, Pref. Stock	100	6 %	6 %	6 %	6 %§	112 –113	111½–112½	112¼	111⅜	– ⅛
1,966,667	Do. do. Def. Stock	100	4½%	5 %	5 %	5 %§	107 –108	106½–107½	107⅜	106⅜	– ⅛
15,000	Do. do. 6 % Cum. 1st Pref.	10	6 %	6 %	6 %	6 %§	13 — 15	13 — 15	..	..	..
15,000	Do. do. 6 % Cum. 2nd Pref.	10	6 %	6 %	6 %	6 %§	12 — 13	12 — 13	12 11/16	12¼	..
250,000	Do. do. 5 % Non-cum. 3rd P., 1 to 250,000	5	5 %	5 %	5 %	5 %§	5⅜— 5⅞	5⅜— 5⅞	5 13/16	5 11/16	..
2,000,000	Do. do. 3½ % Deb. Stock Red.	Stock	3½%	3½%	3½%	..	97 — 99	97 — 99	99	97½	..
1,689,593	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	104 –106	104 –106	..	..	..
179,313	Oriental Telep. and Elec. 1 to 171,504, fully paid	1	6 %	6½%	6½%	6 %	1⅜— 1⅜xd	1⅜— 1⅜	1 11/32	..	..
50,000	Do. do. do. 6 % Cum. Pref.	1	6 %	6 %	6 %	6 %	1 15/16— 1 31/32xd	1 15/16— 1 31/32	..	..	..
100,000	Pacific & European Tel., 4 % Guar. Debs., 1 to 1,000	100	4 %	4 %	4 %	..	100 –103	100 –103	100	..	..
11,839‡	Reuter's	8	5 %	5 %	5 %	5 %§	7⅞— 8¼	7⅞— 8¼	..	..	..
3,237	Submarine Cables Trust	Cert.	6 %	6 %	6 %	..	125–128 xd	125 –128	..	..	..
58,000	United River Plate Telephone	5	7 %	8 %	8 %	..	7 — 7⅛	7 — 7⅛	7⅛	7⅛	..
40,000	Do. 5 % Cum. Pref., Nos. 1 to 40,000	5	5 %	5 %	5 %	..	5⅛— 5⅜	5⅜— 5⅝	5 1/16	..	+
179,947	Do. do. 5 % Debs.	Stock	5 %	5 %	5 %	..	110 –112	110 –112	..	..	..
15,609‡	West African Telegraph, Shares	10	2½	4 %	4½%	4 %	10 — 10⅛	10 — 10⅛	..	..	..
30,008	W. Coast of America, 1 to 30,000 & 53,001 to 53,008	2½	Nil	Nil	Nil	..	1/16— 1/8	1/16— 1/8	..	..	..
150,000	Do. 4 % Debs., 1 to 1,500 guar. by Braz. Sub. Tel.	100	4 %	4 %	4 %	..	100 –102	100 –102	..	..	..
207,930	Western Telegraph, Ltd., Nos. 1 to 207,930	10	7 %	7 %	7 %	..	14½— 14⅝	14½— 14⅝	14 1/16	14¼	..
75,000	Do. do. 5 % Debs. 2nd series, 1906	100	5 %	5 %	5 %	..	101 –103	101 –103	..	..	..
563,380	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	102½–104½	102½–104½	104	..	..
88,321	West India and Panama Telegraph	10	Nil	Nil	Nil	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..
34,563	Do. do. 6 % Cum. 1st Pref.	10	7 %	7 %	6 %	..	8¾— 9	8¾— 9	..	..	..
4,669	Do. do. 6 % Cum. 2nd Pref.	10	Nil	Nil	Nil	..	7⅝— 8	7⅞— 7¾	7¼	..	– ⅛
80,000‡	Do. do. 5 % Debs., Nos. 1 to 1,800	100	5 %	5 %	5 %	..	101 –104	101 –104	..	..	..

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.

850,000	Anglo-Argentine Trams, 260,008 to 490,007	5	..	..	8 %	6 %§	8⅝— 8¾	8⅝— 8¾	8 3/32	8⅜	..
1,300,085	Do. 5½ % Cum. Prefs., 1 to 260,007	5	..	5 %	5 %	5½%	5⅝— 6⅛	6 1/16	5 15/16	..	..
266,600	Do. Permanent, 6 % Deb. Stock, 1888	100	..	6 %	6 %	6 %	141 –144	141 –144	143¼	142	..
200,000	Auckland E. Trams., 5 % 1st Mort. Deb. Stock	100	..	5 %	5 %	5 %	105 –107	105 –107	106½	..	..
530,000	Babcock & Wilcox, 1 to 530,000	1	..	17 %	20 %	16 %‖	3⅜— 4	3⅜— 4	3 15/16	3⅜	..
100,000	Do. do. 6 % Cum. Pref., 1 to 100,000	1	..	6 %	6 %	6 %	1 1/16— 1 1/8	1 1/16— 1 1/8	..	..	..
40,000	British Aluminium 7 % Cum. Pref.	5	Nil	Nil	Nil	..	5 — 5¼	5 — 5¼	..	..	..
20,000	Do. do. "A" 6 % Cum. Pref.	5	Nil	Nil	Nil	..	4⅜— 5⅛	4⅜— 5⅛	..	..	..
20,000	Do. do. 4 % Funding Certs.	5	..	..	..	..	2¾— 3¼	2¾— 3¼	..	..	..
300,000‡	Do. do. 5 % 1st Mort. Debs. Stock Red.	Stock	5 %	5 %	5 %	..	98 –102 xd	98 –102	..	..	..
300,000	British Columbia E. Rail Def. Ord. Stock	100	..	6 %	6 %	..	123 –126 xd	124 –127	126	125	+1
300,000	Do. 5 % Pref. Ord. Stock	100	..	5 %	5 %	..	110 –113	111 –114	108	..	+1
115,000	Do. 5 % Cum. Perp. Pref. Stock	100	..	5 %	5 %	5 %	106 –109	106 –109	..	..	..
240,400	Do. 4½ % 1st Mort. Debs., 1 to 6,250	40	..	4½%	4½%	4½%	103 –105	103 –105%	..	..	..
220,000	Do. 4½ % Vancouver Power Debs., 1 to 2,200	100	..	4½%	4½%	4½%	101 –104	102 –105	104	..	+1
133,801	British Electric Traction	10	8 %	6 %	6 %	..	9⅜— 10⅛	9⅞— 10⅛	10 1/16	9 13/16	+ ⅛
156,437	Do. do. 6 % Cum. Pref.	10	6 %	6 %	6 %	..	11 — 11⅛	11 — 11⅛	11⅛	11 1/16	..
1,000,000‡	Do. do. 5 % Perp. Deb. Stock	Stock	5 %	5 %	5 %	..	121 –123	120 –122	122⅛	121	–1
250,000	Do. do. 4½ % 2nd Deb. Stock Red.	100	..	..	4½%	..	97 — 99 xd	98 –100	99	98	+1
100,000	British Insulated and Helsby Cables	5	10 %	8 %	8 %	8 %§	6⅞— 7⅛	6⅞— 7⅛	6 15/16	..	..
100,000	Do. do. 6 % Cum. Pref.	5	6 %	6 %	6 %	6 %§	5⅞— 6⅛	5⅞— 6⅛	..	..	..
500,000	Do. do. 4½ % 1st Mort. Deb. Red.	100	4½%	4½%	4½%	4½%§	103 –106	103 –106	..	..	..
212,000	British Thomson-Houston 4½ % 1st Mort. Debs.	100	..	4½%	4½%	4½%	98 –100	98 –100	..	..	..
2,000,000	British Westinghouse 6 % Pref., 1 to 200,000 and 275,001 to 475,000	5	..	6 %	Nil	..	2⅜— 2⅝	2⅛— 2⅜	2 5/32	..	– 1/16
1,016,353	Do. do. 4 % Mort. Deb. Stock	100	..	4 %	4 %	4 %	85 — 89	85 — 89	..	..	..
50,000	¶Browett, Lindley & Co., Ord.	£1	Nil	Nil	Nil	..	9/16— 11/16	9/16— 11/16	..	..	..
50,000	¶ Do. do. 6 % Cum. Pref.	£1	Nil	Nil	Nil	..	14/6 to 15/6	14/6 to 15/6	..	..	..
105,731	Brush Electrical Engineering, Ord., 1 to 105,731	2	Nil	Nil	Nil	..	2— 2⅛	2— 2⅛	..	..	..
150,000	Do. Non-cum. 6 % Pref.	2	6 %	6 %	6 %	..	1⅝— 1⅞	1⅝— 1⅞	..	..	..
125,000‡	Do. 4½ % Perp. Deb. Stock	Stock	4½%	4½%	4½%	..	93 — 97	93 — 97	..	..	..
125,000‡	Do. 4½ % Perp. 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	78 — 81	77 — 80	..	..	–1
500,000	Buenos Ayres & Belgrano, 1 to 100,000	5	..	3 %	4 %	..	3¼— 3⅜	3⅛— 3⅜	3 7/32	3 1/16	..
200,000	Do. "A" 6 % Cum. Pref., 1 to 40,000	5	..	6 %	6 %	..	5⅛— 5⅜	5⅛— 5⅜	5 1/16	..	..
137,500	Do. "B" do. 1 to 27,500	5	..	6 %	6 %	..	5 — 5⅛	5 — 5⅛	5 1/16	5 1/16	..
317,700	Do. 5 % Deb. Stock	100	..	5 %	5 %	5 %	106 –108	106 –108	..	..	..
190,000	Do. 5 % 2nd Deb. Stock	100	..	5 %	5 %	5 %	102 –105	102 –105	..	..	..
525,000	Calcutta Trams., 1 to 105,000	5	..	6 %	8 %	7 %§	9 — 9¼	9¼ — 9⅜	9 3/16	..	+ ⅛
163,050	Do. 105,001to 137,610	5	..	..	..	3d.	8¾— 9	8¾— 9	..	..	..
350,000	Do. 4½ % 1st Deb. Stock	100	..	4½%	4 %	4½%	107 –109	107 –109	..	..	..
35,000	Callender's Cable Construction shares	5	15 %	12½%	12½%	10%	11 — 12 xd	11 — 12	11⅛	..	..
40,000	Do. do. 6 % Cum. Pref.	5	5 %	5 %	5 %	5 %	5⅝— 5¾	5⅝— 5¾	..	..	..
300,000	Do. do. 4½ % 1st Mort. Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%	109 –111	109 –111	..	..	..
491,222	Cape E. Trams., 1 to 491,222	1	..	15 %	10 %	5 %§	1 — 1⅛	1 — 1⅛	1 1/16	1	..
450,000	Castner-Kellner Alkali, 1 to 450,000	1	..	4 %	4 %	..	20/- — 21/-	1/16— 1/16	1 1/32	..	—6d.
230,211	Do. do. 4½ % 1st Mort. Deb. Stock	100	..	4½%	4½%	4½%	97 –102	97 –102	99	..	..
1,968,208	Central London Railway, Ord. Stock	Stock	4 %	4 %	4 %	4 %§	91 — 93	92 — 94	93	91½	+1
523,396	Do. do. 4 % Pref. Stock	Stock	4 %	4 %	4 %	4 %§	101 –103	101 –103	102	..	..
523,396	Do. do. Def. do.	Stock	4 %	4 %	4 %	..	83 — 86	83 — 86	84	..	..
1,330,000	City and South London Railway	Stock	3½%	2⅞%	2½%	2 %§	43 — 45	43 — 45	45	43½	..
85,000	Crompton & Co., Nos. 1 to 85,000	8	5 %	2½%	2½%	..	1½— 1⅝	1½— 1⅝	..	..	..
100,000‡	Do. 5 % 1st Mort. Reg. Debs., 1 to 900 of £100, and 901 to 11,000 of £50 Red.	..	5 %	5 %	5 %	..	94 — 99	94 — 99	96	..	..

* A period of nine months. † Quotations on Liverpool Stock Exchange. ‡ Unless otherwise stated all shares are fully paid. § Interim dividends.
‖ And bonus of 10s. ¶ From Manchester Share List.

(Continued on next page.)

SHARE LIST OF ELECTRICAL COMPANIES.—*(Continued).*

ELECTRICAL RAILWAY, MANUFACTURING AND INDUSTRIAL COMPANIES.—*(continued).*

Present Issue.	NAME.	Stock or Share.	Dividends for the last four years. 1902.	1903.	1904.	§1905.	Closing Quotations Nov. 1st.	Closing Quotations Nov. 8th.	Business done week ended Nov. 8th, 1905. Highest	Lowest.	Rise + or Fall−
260,000	Dick, Kerr & Co., 1 to 52,000	†	..	..	10 %	..	8⅛ — 9	8⅜ — 9	8⅛	8⅜	+ ⅛
305,000	Do. do. 6 % Cum. Pref., 1 to 61,000	5	..	6 %	6 %	6 %	6 — 6¼	6 — 6¼	6¼	6	..
294,150	Do. do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	106 —108	106 —108	..	..	..
600,000	Dublin United Trams. (1896), 1 to 60,000	10	..	5%	6 %	3 %	13¼ — 14½	13¾ — 14½	..	..	..
599,700	Do. 6 % Pref. between 1 and 60,000	10	..	6 %	6 %	6 %	15 — 16	15 — 16	..	..	..
63,400	Do. 4 % Debs.	100	..	4 %	4 %	..	99½ —100½	99 —101	..	..	..
300,000	Do. 3½ % "A" Debs.	100	..	3½%	3½%	..	98 — 99	98 — 99	..	..	..
300,000	Do. 3½ % "B" Deb. Stock	100	..	3½%	3½%	..	97¾	96 — 97 xd	..	..	..
99,261	Edison & Swan Utd., "A" shrs., £3 pd., 1 to 99,261	5	Nil	Nil	2½§	..	1⅛— 1⅜	1⅛— 1⅜	..	..	..
17,139	Do. "A" shares, 01—017,139	5	Nil	Nil	2½§	..	2 — 2¼	2 — 2¼	..	..	..
844,023	Do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	85 — 90	85 — 90	..	..	..
100,000	Do. 5 % 2nd Deb. Stock Prov. Certs. all pd.	100	5 %	5 %	5 %	..	92 — 97	92 — 97	..	..	..
112,100	Electric Construction 1 to 112,100	2	6 %	4 %	Nil	..	⅜— ⅞	⅜— ⅞	..	..	..
31,390	Do. do. 7 % Cum. Pref., 1 to 31,390	2	7 %	7 %	7 %	..	1⅞— 2⅛	1⅞— 2⅛	..	..	..
200,000	Do. do. 4 % Perp. 1st Mort. Deb. Stk.	Stock	4 %	4 %	4 %	..	92 — 95	92 — 95	..	..	..
25,000	General Electric Co. (1900), 5 % Cum. Pref.	10	5 %	5 %	5 %	..	9¾ — 10	9¾ — 10	9¾	..	..
200,000	Do. do. 4 % Mort. Deb.	Stock	4 %	4 %	4 %	..	96 —100	96 —100	..	..	..
780,000	Gt. N. & City Rail Pref. Ord. "A" 4 % 1 to 78,000	10	..	3 %	4 %	4 %§	5 — 5½	5⅛— 5⅜	5⅜	5⅛	+ ⅛
96,000	Greenwood & Batley 7 % Cum. Pref.	10	..	7 %	7 %	7 %	10½— 11	10½— 11	..	..	..
80,000	Do. do. 5 % Mort. Debs.	100	..	5 %	5 %	5 %	99½—100½	99½—100½	..	..	..
200,000	Henley's (W. T.), Telegraph Works, Ord.	5	20 %	15 %	15 %	15 %§	12 — 13	12 — 13	..	..	..
200,000	Do. do. 4½ % Pref.	5	4½%	4½%	4½%	..	5⅛— 5⅜	5⅛— 5⅜	5⅜	5	..
45,900	Do. do. 4½ Mort. Deb. Stock	Stock	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
50,000	India-Rubber, Gutta-Percha & Telegraph Works.	10	10 %	10 %	5 %	2½%§	15½— 16½	15½— 16½	..	..	..
800,000	Do. do. 4% 1st Mort. Deb.	100	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
37,500	†Liverpool Overhead Railway, Ord.	10	1½%	1⅜%	1½%	..	2⅜— 2⅝	2⅜— 2⅝	..	..	..
10,000	† Do. do. Pref. £10 paid	10	5 %	5 %	5 %	5 %	9 — 9½	8½— 8¾	..	..	− ¾
600,070	London United Trams (1901), 1 to 50,007	10	..	8 %	6 %	4 %§	10 — 11	10 — 11	10 1/16	..	..
399,930	Do. do. 60,008 to 100,000 (£4 paid)	10	..	8 %	6 %	4 %§	4 — 5	4 — 5	..	..	..
1,125,000	Do. do. 5 % Cum. Pref., 1 to 125,000	10	..	5 %	5 %	5 %	9⅞— 10½	9⅞— 10½	..	..	..
1,331,000	Do. do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	4 %	100 —103	100 —103	102¾	101	..
150,000	Peebles (B.) & Co. 6 % Cum. Pref., 20,001 to 40,000	5	..	..	6 %	6 %	4⅞— 5⅛	4⅞— 5⅛	..	..	..
240,500	Potteries E. Trc., 20,001 to 40,000 & 50,001 to 54,500	10	..	5 %	5 %	..	8⅞— 9¼	8⅞— 9¼	..	..	..
240,500	Do. 5 % Cum. Pref., 1 to 20,000 & 40,001 to 44,500	10	..	5 %	5 %	5 %	9 — 9¼	9¼— 9⅜	..	..	− ⅛
245,000	Do. 4½ % Deb. Stock	100	..	4½%	4½%	..	101 —104	103 —106	..	..	+2
37,350	Telegraph Construction and Maintenance	12	20 %	20 %	15 %	..	33½— 35½	33 — 35	33½	33	− ½
150,000	Do. 4 % Deb. Bds., 1 to 1,500 Red. 1909	100	4 %	4 %	4 %	..	102 —104	102 —104	..	..	..
3,599,200	Undergd. E. R., Lon., 5 % Profit Shar. S. Nts.	..	..	..	5 %	5 %	99½—100½	99½—100½	..	..	..
540,000	Waterloo & City Railway, Ord. Stock	100	3⅛%	3½%	3⅛%	3 %§	88 — 90	87 — 89	..	..	−1
333,330	Willans & Robinson, 1 to 30,000 & 80,001 to 116,666	5	..	6 %§	..	..	1¼ — 2	1¼ — 2	1⅞	..	..
333,330	Do. 6 % C. P., 30,001 to 80,000 & 125,001 to 141,666	5	..	3 %	..	..	2¼ — 3½	2¼ — 3½	..	..	..
246,806	Do. 4 % 1st Mort. Deb. Stock	100	..	4 %	4 %	..	77 — 82	77 — 82	..	..	..

ELECTRICITY SUPPLY COMPANIES.

70,000	Bromley (Kent) E.L. & P., 1 to 14,000	5	..	5 %	5⅛%	4 %§	5¼— 5⅜	5¼— 5⅜	..	..	..
50,000	Do. do. 4½ % 1st. deb. stock	100	..	4½%	4½%	4½%	102 —105 xd	102 —105 xd	..	..	..
29,377	Brompton & Kens. Elec. Lt. Sup., Ord., 1 to 20,000	5	8 %	10 %	10 %	..	9⅜— 10⅛	9¼— 10	9⅜	..	− ⅛
29 623	Do. do. 7 % Cum. Pref.	5	7 %	7 %	7 %	..	9¼— 9⅜	9¼— 9⅜	..	..	..
10 782	Central Electric Supply 4 % Guar. Deb. Stock	100	4 %	4 %	4 %	..	105 —108	105 —108	105	..	..
80,000	Charing Cross and Strand Electricity Supply	5	10 %	8 %	8 %	5 %§	7⅛— 8	7 — 7⅛	..	..	− ⅛
80,000	Do. do. do. 4½ % Cum. Pref.	5	4½%	4½%	4½%	..	5⅛— 5⅜	5⅛— 5⅜	..	..	..
40,000	Do. "City Undertaking" 4½ % Cum. Prf.	5	4½%	4½%	4½%	..	4⅜— 5	4⅜— 5	..	..	..
40,000	Do. do. 1903	5	..	4½%	4½%	..	4⅜— 5	4⅜— 5	4⅜	4⅜	..
350,000	Do. do. 4 % Deb. Stock Red.	100	4 %	4 %	4 %	..	103 —105	103 —105	..	..	..
44,436	Chelsea Electricity Supply, Ord.	5	4½%	5½%	6 %	4½%§	5⅜— 6¼	5⅜— 6¼	5⅞	5⅜	..
150,000	Do. do. 4½ % Deb. Stock Red.	Stock	4½%	4½%	4½%	4½%§	110 —112	110 —112	..	..	..
70,595	City of London Elec. Lighting, Ord. 40,001—110,595	10	5 %	5 %	6 %	..	12¼— 12⅝	11⅜— 12¼	12¼	12	− ⅜
40,000	Do. 6 % Cum. Pref., 1 to 40,000	10	6 %	6 %	6 %	..	13¼— 14¼	13¼— 14¼	13 1/16	..	..
400,000	Do. 5 % Db. Stk., Scrip. (iss. at 115) all pd.	..	5 %	5 %	5 %	..	124 —128	124 —128	..	..	..
300,000	Do. 4½ % 2nd Db. Stk., Prov. Crts., all pd.	100	4½%	4½%	4½%	..	104 —106	104 —106	..	..	..
40,000	County of London Electric Lighting, Ord. 1—40,000	10	4 %	4 %	4½%	4 %§	9⅜— 10¼	9⅜—10¼	..	..	..
30,000	Do. do. 6 % Pref., 40,001—60,000	10	6 %	6 %	6 %	..	12⅜— 12⅞	12⅜— 12⅞	..	..	..
400,000	Do. do. 4½ % Deb. Stock	..	4½%	4½%	4½%	..	111 —114	111 —114	113	..	..
250,000	Do. do. 4½ % 2nd Deb. Stock	Stock	4½%	4½%	4½%	..	102 —104 xd	102 —104 xd	..	..	..
70,000	Edmundson's Electric Corporation, Ord. Shares	5	7 %	7 %	7 %	..	5⅜— 6	5⅜— 6	5 1/16	5 1/16	..
80,000	Do. do. 6 % Cum. Pref.	..	6 %	6 %	6 %	..	6⅜— 6⅝ xd	6 — 6¼ xd	6⅛	..	..
300,000	Do. do. 4½ % 1st Mort Deb. Stk	100	4½%	4½%	4½%	..	109 —111	109 —111	..	..	..
50,000	Folkestone, 1 to 10,000	5	..	5½%	5½%	4 %§	5¼— 5⅜	5¼— 5⅜	..	..	..
50,000	Do. 5 % Cum. Pref., 1 to 10,000	5	..	..	..	5 %	5 — 5⅛	5 — 5⅛	..	..	..
50,000	Do. 4½ % 1st. Deb. Stock	100	..	4½%	4½%	4½%	100 —103	100 —103	..	..	..
65,000	Hove, 1 to 13,000	5	..	8½%	8½%	..	8⅛— 8⅜	8⅛— 8⅛	..	..	..
10,000	Do. New (£5 10s. paid)	£3	..	8½%	8½%	..	5⅞— 6⅛	6 — 6¼	..	..	+
37,300	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	95 — 98	95 — 98	..	..	..
7,300	Do. 4½ % Deb. Stock	100	..	4½%	4½%	4½%	98 —102	99 —101	..	..	..
21,000	Kensington and Knightsbridge Electric Ord.	5	10 %	12½%	12 %	..	12 — 12⅜	11⅛— 12⅛	..	..	− ⅛
136,000	Do. do. do. 4 % Deben. Stk.	Stock	4 %	4 %	4 %	..	98 —101	98 —101	..	..	..
111,000	London Electric Supply Corporation, Limited, Ord.	3	Nil	Nil	3 %	..	1⅜— 2⅛	1⅜— 2⅛	..	..	..
60,000	Do. do. do. 6 % Pref.	5	6 %	6 %	6 %	..	5⅛— 5⅝	5 — 5⅛	5	..	− ⅛
371,895	Do. do. 4 % 1st Mort. Deb. Stk. Red.	Stock	4 %	4 %	4 %	..	99 —102	99 —102	..	..	..
100,000	Metropolitan Electric Supply, 1 to 100,000	5	7½%	8½%	10 %	10%§	10 — 10½	10 — 10⅛	10 7/16	10 5/16	..
76,121	Do. 4½ % Cum. Pref. 1—71,106, £3 pd.	5	4½%	4½%	4½%	..	5⅝— 5⅞	5⅝— 5⅞	5 13/16	5 11/16	..
220,000	Do. 4½ % 1st Mort. Deben. Stock	..	4½%	4½%	4½%	..	109 —113	109 —113	..	..	..
250,000	Do. 3½ % Mort. Deben. Stock Redem.	Stock	3½%	3½%	3½%	..	98 —100	97 — 99	97½	..	−1
250,000	Midland Electric Corporation, 4½ % 1st Mort. Deb.	100	4½%	4½%	4½%	..	101 —103	101 —103	102½	..	..
285,045	Newcastle-on-Tyne, 1 to 57,009	5	..	8 %	8 %	2½%§	8 — 8¼	8 — 8¼	..	..	..
89,955	Do. 57,010 to 75,000	5	..	..	..	2½§	8 — 8¼	8 — 8¼	..	..	..
285,045	Do. 5 % Pref., 1 to 57,009	5	..	5%	5	5 %	6⅛— 6⅜	6⅛— 6⅜	..	..	..
89,955	Do. 57,010 to 75,000	5	..	..	..	2½§	6⅛— 6⅜	6⅛— 6⅜	..	..	..
10,852	Notting Hill Electric Lighting	10	6 %	6 %	7 %	..	14 — 15	14 — 15	..	..	..
59,000	Do. do. 4 % 1st Mort. Deb.	100	4 %	4 %	4 %	..	98 —100	98 —100	..	..	..
92,500	Oxford, 1 to 96 and 407 to 18,810	5	..	6½%	7 %	5 %§	6⅜— 6⅝	6⅜— 6⅞	..	..	..
50,000	Do. 4 % Deb. Stock	100	..	4 %	4 %	4 %	100 —102	100 —102	..	..	..
40,000	St. James' and Pall Mall Electric Light, Ord.	5	14½%	14½%	14½%	10%§	14 — 15	13½— 14½	13⅜	..	− ½
20,000	Do. do. 7 % Pref. 20,081 to 40,080	5	7 %	7 %	7 %	7 %§	8½ — 9¼	8½ — 9¼	..	..	..
150,000	Do. do. 3½ % Deb. Stock Red.	100	3½%	3½%	3½%	..	98 —100	98 —100	..	..	..
12,000	Smithfield Markets Electric Supply, Ord.	5	2½%	4 %	4 %	..	2 — 2¼	2 — 2¼	2 1/16	..	..
50,000	Do. do. do. 4 % Deb. Stock	Stock	4 %	4 %	4 %	..	76 — 80	76 — 80	..	..	..
65,000	South London Electricity Supply, Ord.	5	12½%	3 %	4 %	..	3½— 4	3½— 4	..	..	..
100,000	South Met. Elec. Lt. & Power (Ord.	1	Nil	Nil	Nil	..	1⅜— 1⅝	1⅜— 1⅝	..	..	..
50,000	*(Late Blackheath and Greenwich* 7 % Pref.	1	Nil	7 %	7 %	..	1 1/16— 1 1/16	1 1/16— 1 1/16	..	..	..
100,000	*Dist. E.L.Co.)* 4½ % 1st Deb. Stk.	100	4½%	4½%	4½%	..	105 —108	105 —108	..	..	..
30,000	Urban Electric Supply, Ord.	5	5 %	5 %	5 %	..	4½— 4⅝	4½— 4⅝	..	..	..
30,000	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	5 — 5¼	5 — 5¼	..	..	..
200,000	Do. do. 4½ % 1st Mort. Db. Stk. Red	100	..	..	4½%	..	103 —105	104 —106	104⅜	..	+1
110,000	Westminster Electric Supply, Ord.	5	12 %	13½%	14 %	13%§	12½— 12⅝	12⅝— 12⅞	12⅝	12 7/16	+ ⅛
28,151	Do. do. 5 % Cum. Pref.	5	5 %	5 %	5 %	..	6 — 6½	6 — 6½	6⅝	..	..

Shares not officially quoted:—Mackay Companies, ord., 50—51. Pref. 75—76.
† Unless otherwise stated all shares are fully paid. § Interim dividends.

Bank rate of discount 4 per cent. (September 28th, 1905).

PROCEEDINGS OF INSTITUTIONS.

IS MACHINE STOKING ECONOMICAL?

By Alfred W. Bennis, M.I.Mech.E., A.I.E.E.

(Paper read before the Keighley Association of Engineers.)

(Concluded from page 706.)

6. In a series of tests carried out on marine boilers with hot air at the Sheffield Corporation Sheaf Street Electricity Works, by Mr. S. E. Fedden, A.M.I.C.E., M.I.M.E., the following facts, which are not without significance, were established: The rated capacity of the boilers with hand firing was 9,000 lb. to 10,000 lb. of water per hour; with mechanical firing and hot air, 17,652 lb. of water were evaporated per hour with an efficiency of 79·9 per cent. These tests brought out most clearly the high attainable efficiency, with an increased evaporation of about 80 per cent., and this with small slack coal as against through and through by hand firing.

Now, we may ask, if you were racing men and backed a horse that ran 9,000 yards while the winner won the race by running 17,500 yards in the same time, other things being equal, would you ever back the 9,000 yards horse again? Especially if the 17,500 yards horse was fed on bran while the other had oats?

I should here like to enter my protest against the false economy of the users of steam power who make it a constant rule to buy the cheapest machines, *i.e.*, a machine for which the smallest initial outlay is required. Here is a case in point. Two stokers were installed for a firm known to me, one costing 50 per cent. more than the other. In less than a year the more expensive of the two had paid for the difference four times over; in other words, it had saved twice the cost of the cheaper machine.

The following tests of recent date speak for themselves:—

City of Coventry.—On the supply of cheap electrical energy for industrial purposes, Mr. Joseph A. Jeckell, the manager of the electricity department of the Corporation of Coventry, read a paper before the members of the Birmingham Electric Club, and figures are given showing the results of working at the Corporation electricity works, Coventry.

In 1901 the station cost pence per unit was 3·05d. In May two boilers were fitted with the Bennis stokers, and in October, 1902, two more boilers were fitted. In 1902 the cost went down to 2·43d. In 1903, when the costs were affected by the change in the stoking, the station costs went down to 1·51d. In 1904 they went down to 1·16d. In 1904 two more boilers were fitted with these machines, and in 1905 the Coventry cost stands at ·85d., which is a world's record. They had previously at work a cheaper stoker made by a Burnley firm, and the test in 1902 briefly showed that the dearer machine gave the extra evaporation per hour of 17½ per cent. with a reduction in fuel cost per 1,000 gallons of 53 per cent. Notice the following tests (see Tables A, B, C, D, E):—Arlesey Portland Cement Co.; Leeds Copper Works; Butterley Co.; Belfast; Brintons, Ltd.

These tables give some idea of the saving effected by the use of machinery, and of the progress made towards the goal of the stoker manufacturer, viz., cheap steam with a smokeless chimney.

In a paper read a short time since before the Bradford Engineering Society, an opinion was expressed that the nearest approach to perfect firing might be obtained by a well-designed and well-managed mechanical stoker. The writer of that paper further asserted that, to some extent, machine stokers have a bad name, and are viewed by a great number of men with some distrust. While admitting the truth of the assertion, we think it only due to point out that this bad name and distrust are probably the result of the folly of the manufacturer too anxious to do business, who has rashly guaranteed impossible results.

Possibly a second cause to which these detrimental views of the mechanical stoker may be attributed, is the fact that many badly-designed stokers have been placed on the market, causing actual loss instead of gain.

A third cause may be due to the prejudice of the individual engineer, who receives a bad impression of a certain make of stoker, and then condemns all stokers as bad.

The historic aspect of machine firing has been so frequently before the members of the various technical societies during the last quarter of a century, that we have thought it best to omit the story of the early attempts of machine-firing, interesting though it must always be to the student of the evolution of the mechanical stoker of to-day, and the days to come. The ably told story will be found carefully preserved in the archives of the Institution of Civil Engineers, the Institution of Electrical Engineers, and the Technical Society of Mill Managers, &c. We shall do no more than refer to it here.

Everybody here is familiar with the process of combustion of coal. In hand-firing, when a quantity of coal is thrown on the fire, the supply of air is not altered; the consequence is a production of carbonic oxide for a short time. Now, whatever this loss amounts to, two-thirds of the heat possible to be produced from each pound of carbon is wasted, and this occurring again and again each time a man fires, it amounts to a considerable loss at the day's end.

But if, on the other hand, the fire is adjusted to produce carbonic acid gas when the coal is fired, there will be too much air when the coal is burnt through, and heat will be carried up the chimney by the excess of air. This source of waste is entirely avoided by efficient machine firing.

There is another point which up to now has been entirely lost sight of; it is a most important consideration, and is the reason why such high efficiencies have been obtained by what I might term high-speed stokers, burning a lot of coal and doing heavy evaporations. The rate of transmission of heat varies as the square of the difference of temperature between the water and the furnace temperature, and so it comes that, other things being equal, the hotter the furnace the more efficient the boiler. Therefore work with as little excess of air as possible, but not a fraction too little, or down comes the temperature, and see that the air supply is properly distributed over the furnace.

A self-cleaning furnace is essential, and one in which a controllable supply of air is arranged for, is imperative; otherwise it becomes impossible to adjust the conditions to the best advantage.

History repeats itself, the old story of the compound or single engine controversy is now being repeated in boiler firing. The single cylinder is hand-firing; the compound engine machine-firing, and the arguments used in the great Oldham controversy are much the same, but the evolution and survival of the fittest will carry the day.

(A.) Result of comparative boiler tests made at the Arlesey Portland Cement Works, branch of the Associated Portland Cement Manufacturers (1900), Ltd. These tests were made on a Lancashire boiler, 8 ft. 6 in. × 32 ft., to determine the comparative efficiency of hand-firing and the "Bennis" patent gold medal machine stoker and patent self-cleaning compressed air furnace:—

	Hand.	Bennis.
Date of test, 1903	Aug. 28th	Sept. 11th
Duration	8 hours	8 hours
Feed water temperature (average) ...	129° F.	131° F.
Steam pressure (average)	118 lb. per sq. in.	123 lb. per sq. in.
Factor of equivalent evaporation as from and at 212° F.	1·130	1·129
Sort of coal used	Tinshelf	Ibstock pea nut.
Price of coal delivered	14s. 10d.	12s. 9d.
Weight of coal burnt:—Total	9,856 lb.	15,680 lb.
Per hour ...	1,232 lb.	1,960 lb.
Water evaporated, actual:—Total ...	5,502 gals.	9,847 gals.
Per hour...	687·75 gals.	1,230·87 gals.
Per lb. of coal	5·58 lb.	6·28 lb.
Water evaporated as from and at 212° F.:—Total	6,217 gals.	11,117 gals.
Per hour	777·1 gals.	1,389·6 gals.
Per lb. of coal	6·31 lb.	7·09 lb.
Cost of coal to evaporate 1,000 gallons as from and at 212° F.	125·93d.	96·34d.

Advantages obtained by the use of the "Bennis" stoker and furnace:—

Extra evaporation per hour...	78·82 per cent.
Extra evaporation per lb. of coal	12·36 „
Reduction in cost of coal per 1,000 gallons	23·53 „

The actual saving in cost of coal is 29·64d. per 1,000 gallons evaporated as from and at 212° F., and taking only the work done during the eight hours of the machine-fired test (namely, 11,117 gallons evaporated as from and at 212° F.) the saving in cost of coal during that test amounts to £1 7s. 5d.

(B.) Results of comparative boiler tests made at the works of the Leeds Copper Works, Ltd.—The tests were made on a Galloway boiler, 8 ft. × 30 ft., to determine the comparative efficiency of hand-firing and the "Bennis" new patent stoker and self-cleaning compressed air furnace:—

	Hand.	Bennis.	Bennis.
Date of test, 1903 ...	June 10th	June 25th	June 26th
Duration	8½ hours	8½ hours	8½ hours
Feed water temperature (average)	148° F.	168° F.	159° F.
Steam pressure (average)	112 lb.	119 lb.	101 lb.
Factor of equivalent evaporation as from and at 212° F	1·109	1·089	1·094
Sort of coal used	Glass Houghton	Smudge	Glass Houghton
Price of coal per ton ...	7s. 6d.	5s. 3d.	7s. 6d.
Weight of coal burnt—			
Total	7,097 lb.	10,752 lb.	9,184 lb.
Per hour	834·9 lb.	1,264·9 lb.	1,080·5 lb.
Water evaporated, actual			
Total	4,723 gals.	7,298 gals.	7,513 gals.
Per hour	555·6 gals.	858·6 gals.	883·9 gals.
Per lb. of coal ...	6·655 lb.	6·788 lb.	8·181 lb.
Water evaporated as from and at 212° F.—Total...	5,238 gals.	7,948 gals.	8,219 gals.
Per hour	616·2 gals.	935·0 gals.	967·0 gals.
Per lb. of coal ...	7·370 lb.	7·392 lb.	8·950 lb.
Cost of coal to evaporate 1,000 gallons as from and at 212° F.	54·44d.	38·05d.	44·89d.

Advantages obtained by the use of the "Bennis" stoker and furnace:—

Extra evaporation per hour	51·73 %	56·92 %
Extra evaporation per lb. of the same coal	—	21·26 %
Reduction in cost of coal per 1,000 gals. evaporated	30·11 %	17·53 %

(C.) Result of comparative boiler tests made at the works of the Butterley Iron Co., Ltd., Codnor Park. Hand firing *versus* the "Bennis" patent gold medal machine stoker and patent self-cleaning compressed-air furnace:—

	Hand.	Bennis.
Date of test, 1902	Jan. 18th	Jan. 23rd
Duration of test	5 hours	5 hours
Type of boiler	Lancashire	Lancashire
Size of boiler	7 ft. 6 in. × 30 ft.	7 ft. 6 in. × 30 ft.
Total water evaporated	2,320 gals.	4,540 gals.
Total coal burnt	2 tons 3 cwt.	3 tons 4 cwt.
Water evaporated per hour	464 gals.	908 gals.
Coal burnt per hour	963 lb.	1,434 lb.
Water evaporated per lb. of coal ...	4·82 lb.	6·33 lb.
Price of coal per ton at pit	2s. 6d.	1s.
Cost of fuel to evaporate 1,000 gals. of water	2s. 3¾d.	8½d.
Extra evaporation per hour	—	95·69%
Extra evaporation per lb. of coal ...	—	31·48%
Net saving in weight of coal	—	23·94%
Net saving in cost of evaporation ...	—	69·58%

The coal used on January 23rd could not be burnt except on the Bennis furnace.

(D.) Test made at the Belfast Corporation electricity works, on a Babcock & Wilcox water-tube boiler fitted with "Bennis" patent gold medal machine stoker and patent self-cleaning compressed air furnace. Present on behalf of the Corporation of Belfast, T. W. Bloxom; on behalf of Ed. Bennis & Co., Ltd., A. W. Bennis and G. A. Rossetti; on behalf of Babcock & Wilcox, Ltd., A. E. Parker.

Date of trial	March 7th, 1902
Duration of trial	5¼ hours
Coal used	"Mynydd Newydd"
Calorific value of coal by calorimeter ...	14,049 B.TH.U. per lb.
B.TH.U. required to evaporate 1 lb. of water, including superheat	1,234·5 B.TH.U.
Heating surface of boiler	4,228 sq. ft.
Grate surface	50 sq. ft.
Ratio of heating to grate surface	84·56 to 1
Steam pressure by gauge (average) ...	161·4 lb. per sq. in.
Average temperature of superheated steam leaving boiler	525° F.
Number of ° F. of superheat	154
Feed-water temperature (average)... ...	66·5° F.
B.TH.U. required to evaporate 1 lb. of water, omitting superheat	1,160·6 B.TH.U.
Factor of equivalent evaporation, as from and at 212° F.	1·2018
Total fuel burnt	9·243 lb.
Fuel burnt per hour	1,760·6 lb.
Fuel burnt per sq. ft. of grate per hour ...	35·2 lb.
Percentage of carbonic acid in flue gases leaving boiler (average)	14·5 per cent.

	As from actual conditions.	As from and at 212° F.
Total water evaporated, ...	92,000 lb.	110,565·6 lb.
Water evaporated per hour, ...	17,523·8 lb.	21,060·1 lb.
Water evaporated per sq. ft. of boiler heating surface per hour	4·14 lb.	4·98 lb.
Water evaporated per lb. of coal	9·95 lb.	11·96 lb.
Thermal efficiency of boiler with Bennis stoker and furnace (omitting superheat)		82·23 per cent.
Thermal efficiency of boiler with Bennis stoker (including superheat)		87·46 per cent.

(E.) Report of comparative trials of "hand-firing" and the "Bennis" patent gold medal machine stoker with self-cleaning compressed air furnaces at Messrs. Brinton's (Ltd.) Works, Kidderminster:—

	March 12th	May 13th
Date of trial, 1903	7 hours	7 hours
Duration of trial	Lancashire	Lancashire
Type of boiler	30 ft. × 7 ft. 2 ft. 9 in. flues	30 ft. × 7 ft. 2 ft. 9 in. flues
Number of boilers tested, Nos. 1 & 2	2	2
Grate surface, each boiler	33 sq. ft.	33 sq. ft.
Heating surface, each boiler ...	840 sq. ft.	840 sq. ft.
Ratio boiler heating surface to grate	25·41	25·41
Coal used	Dudley rough	Slack No. 7
Calorific value of fuel by calorimeter	10,941 B.T.U.	—
Total fuel consumed	11,424 lb.	14,448 lb.
Total ash and clinker made ...	1,129 lb.	1,175 lb.
Fuel consumed per sq. ft. of grate surface per hour	25 lb.	31 lb.
Total water evaporated	75,500 lb.	111,100 lb.
Water evaporated per hour per boiler, actual condition	5,393 lb.	7,935 lb.
Water evaporated per lb. of fuel, actual condition	6·60 lb.	7·68 lb.
Water evaporated per lb. of coal as from and at 212° F. boiler and economiser	7·69 lb.	8·97 lb.
Total economical efficiency ...	—	58 per cent.
Black smoke	Nearly constant	None.
Average steam pressure, by gauge	106 lb.	112·5 lb.
Average temperature, feed to economiser	90° F.	90° F.
Average temperature, feed to boiler	202° F.	200° F.
Average temperature, gases leaving boiler	770° F.	693° F.
Average temperature, outside atmosphere	43° F.	43° F.
Draught in inches of water ...	11/16 in.	⅝ in.

THE PROBLEM OF THE GAS TURBINE.

By Dugald Clerk, M.Inst.C.E.

(Abstract of Presidential Address delivered to the Junior Institution of Engineers, November 3rd, 1905.)

The wonderful success obtained by your distinguished Past-President, the Hon. C. A. Parsons, and his many able followers, with the steam turbine in its various forms, has naturally attracted the attention of engineers to the apparently analogous problem of the internal combustion turbine. Accordingly, much mathematical and engineering ability has been recently devoted to the subject—so far, I am sorry to say, without concrete result.

One gas turbine only has really rotated within my own direct knowledge. It was designed by Mr. F. W. Lanchester, of Birmingham, to operate with the exhaust gases from one of the petrol engines used in his well-known motor-cars. He assured me a few days ago that it really rotated at a high speed, and made a loud shrieking noise, but only gave, he said, a total brake horse-power equal to that capable of being evolved by two blue-bottle flies. This power he did not consider to be satisfactory.

It appears to me that most of those who have written on gas turbines, and have even designed and patented them, have given too little weight to certain differences between the steam and internal combustion engine problems.

Even Mr. Parsons himself, so early as his first turbine patent (No. 6,735, of 1884), appears to have been of opinion that the hot gas or internal combustion turbine presented practically the same problem as the steam turbine.

The temperatures quite common in ordinary gas engine practice range as high as 2,000° C., although in the best practice, for most economical results, 1,500° C. or 1,600° C. appears to be an upper limit. If one realises what the temperature 2,000° C. means, it becomes very evident that no turbine constructed either on the lines of Parsons or Laval could possibly be made to work with a continuous supply of such gases; 2,000° C. is considerably over the melting point of platinum.

Seeing the impossibility of constructing a turbine with materials to stand a high temperature, many have proposed to convert high temperature into kinetic energy. Such proposals include the compressing of a gaseous mixture to, say, 50 lb. or 60 lb. above atmosphere, the igniting of that mixture within a combustion chamber at constant pressure, and the expansion of the mixture through an expanding jet of the Laval type. The rapidly-moving particles at the relatively low pressure and temperature are then allowed to impinge upon rapidly-rotating blades of sickle configuration, and they are supposed to give up their energy of motion to those blades, and so expend work upon the turbine. This appears to be the most feasible of all the gas turbine proposals.

Assuming air to be the working fluid, and specific heat to be constant through the temperature range, it is easy to calculate the efficiency of the Joule or Brayton cycle, which these operations in effect represent. It would be useless to attempt to work a turbine at a pressure so low as to be relatively inefficient compared with the gas engine, so I have chosen a Joule cycle of, say, 48 per cent. ideal efficiency, which in a cylinder gas engine would probably give in practice about 30 per cent. indicated efficiency. For this ideal efficiency the pressure of compression would require to be 141 lb. per sq. in. absolute. To give power with a reasonably small pump, I shall assume a maximum temperature of 1,700° C. That is, assuming a perfect compressor and a perfect nozzle expander, the temperature would only fall from 1,700° C. to 750° C. Plainly this temperature would be too high for a Laval disk with blades In order to get a reasonable temperature on expansion, it would be necessary to assume a maximum temperature in the combustion chamber no higher than 1,000°, and this would bring down the temperature after complete expansion to about 500°, which no doubt steel turbine blades can be expected to stand for some considerable time.

With these assumptions, the gas turbine would not be very economical, as compared with cylinder engines, even assuming all difficulties overcome. The theoretical and practical difficulties, however, are very serious indeed.

I am not aware of any turbine compressor capable of compressing up to 140 lb. absolute from atmosphere with anything like 60 per cent. efficiency. Before success could be attained, this efficiency of compression should be at least 90 per cent., in order to allow for unavoidable mechanical and other losses in the subsequent processes.

Assuming, however, even 90 per cent. efficiency from a turbine compressor, and assuming that we have a compressed gaseous mixture burning freely in the combustion chamber at the desired pressure and temperature, we have yet to face the problem of the expanding nozzle. It is always assumed that with the use of an expanding nozzle, temperature drop can be as certainly attained as with an expanding piston in a cylinder. This, it seems to me, has been by no means proved.

To obtain a sufficient temperature drop in an expanding nozzle necessitates the practical absence of turbulent motion of every kind; that is, to expand adiabatically the jet must be so constructed that there is an absolutely smooth flow from high pressure to low, and no impact or loss of velocity from any cause whatever. So far as I understand expanding jets, no adiabatic expansion so perfect as this has ever been obtained.

Assuming, however, that the efficiency of expansion in such a jet is, say, 90 per cent. We now come to the question of the efficiency of conversion by the turbine blades. In many calculations from diagrams, it is assumed that the efficiency of conversion of motion into work is practically perfect. This, however, is by no means the case in present turbines. The reason of this is obvious. It is

impossible to arrange the impact of a rapidly moving gas with a turbine blade or blades in such a manner as to entirely avoid turbulent motion. A certain proportion of the energy existing in the gas in the form of motion is inevitably lost whenever this gas comes into contact with any solid surfaces. So much is this the fact that in designing steam turbine blades for any type of turbine, the shape of the blades, the shape of the space between the blades, both moving and fixed blades, or fixed jet and moving blades, is of the first importance, and it has only been found by experiment that certain shapes of blades and passages have a much higher efficiency of conversion than other shapes. In this respect, too, the turbine principle is inferior to the cylinder and piston.

Although the efficiency of expansion is relatively low for gases in steam turbines, yet the turbine offers a great advantage in total work obtained from steam. This is due to the fact that the turbine avoids initial condensation; and, further, it permits of the utilisation of a very long range of expansion at the low pressure end, which is not available in the case of steam engines. By saving, therefore, in minimising initial condensation, and in obtaining added work from pressures wasted in the ordinary steam engine, the Parsons steam turbine more than compensates for any inefficiency of expansion as compared with the cylinder engine. It is well known, however, in turbines of practically all constructions, including Mr. Parsons', that the efficiency of the steam turbine at the high pressure end is not so great as that at the low pressure end. This is a small difficulty with the steam turbine, but it is a very great difficulty with the gas turbine. I cannot see how it is possible with present knowledge to obtain an efficiency of conversion in a gas turbine greater than 80 per cent. This, of course, is partly due to the high velocity of the issuing hot gases. To produce an efficient gas turbine, therefore, on the favourite cycle so much discussed recently, it is necessary first to have a very efficient compressor, a very efficient expanding nozzle, and a very efficient conversion when the moving gases strike the turbine blades. Using the numbers I have suggested, of 90 per cent. efficiency of compression, 90 per cent. efficiency of nozzle expansion, and 80 per cent. efficiency of conversion in turbine, we have, with a cycle having negative work equal to 0·4, the following efficiencies: To get 0·4 of work in compression, we shall require 0·445 of work put into the compression. On expanding in the nozzle we shall obtain 0·9 only of the total energy of the flame gases in the shape of kinetic energy, and of that 0·9 we shall only get 0·8 returned in the shape of available work by the turbine part. That is, we shall get a total work from the turbine of 0·72, and deducting the negative work of $0·72 - 0·445 = 0·275$; that is, from a cycle which should give us 0·6 in work, we shall only get 0·275, or about 22 per cent. The practical efficiency of an engine of this kind will only be 22 per cent., even assuming the high efficiencies of compression and jet expansion which I have mentioned. In my view, no such efficiencies of compression or jet expansion are at present known, and accordingly there appears no likelihood of the production of any gas turbine which can rival the reciprocating gas engine in efficiency and in economy.

This thermal efficiency of 22 per cent. assumes no losses in the combustion chamber due to heat conduction, no losses in the expanding jet due to heat conduction, and no losses in the turbine itself from the same cause. Considering the losses in gas engine cylinders of small size, it would not be too much to allow in a turbine a heat flow loss of at least 25 per cent. This, of course, reduces the efficiency from 22 per cent. to 16·5. In arriving at this figure, I have assumed that no greater loss would be incurred from heat flow in the turbine than in the cylinder engine; but even with reduced temperatures when striking the turbine, the very fact of requiring a reservoir for combustion to operate, and the forcing of the whole of the hot products through a relatively small nozzle, necessarily means greater loss than I have assumed. Assuming, however, no more loss than I have given, an engine with an efficiency of only 16½ per cent. of the total heat given to it could not compete with internal combustion motors of existing construction. It may be said that the advantage of continuous rotation is so great that even at this low efficiency the gas turbine would be successful. Personally, I doubt it very much, because the mechanical difficulties with gas turbines would be much greater than the mechanical difficulties of the steam turbine. Comparatively small clearances are necessary for economy. The use of even temperatures so high as 400° C. or 500° C., by introducing unequal expansions, greatly increases the difficulty of obtaining economy. No doubt if a plentiful supply of relatively low temperature gases under considerable pressures could be obtained, these gases might with advantage be expanded in a nozzle, and used to operate a turbine. To carry this idea into effect has already been attempted, as I have said, by Mr. Lanchester, and there is some hope of operating in this way. I fear that the temperature of the gases in the exhaust of the gas engine is too high as they stand to be so used. Gases from an exhaust or air supercompression engine, such as I have lately been working with, could, no doubt, give considerable efficiencies in turbines. I do not see, however, any solution of the gas turbine problem here, because the amount of energy available for the turbine after the gases leave the gas engine is too small for consideration in connection with any really high power machines.

I quite agree with Prof. Reeve that the more hopeful line for the gas turbine lies in the use of steam to provide the working fluid under compression without a compressor, and in the heating of this steam when produced by a very small quantity of combustible mixture of gas and air under pressure. Such a turbine would be a compromise between what I may call the flame turbine and the steam turbine, and it presents more possibilities; but its efficiency would not be high, although, no doubt, such a machine could be got to operate mechanically with fair success.

From what I have said, you will see that my view of the future of the gas turbine is not favourable; but, notwithstanding, the subject is so fascinating that many inventors and scientific men will, doubtless, continue to investigate the problem, and possibly new solutions may be discovered which are not dreamt of to-day.

LEGAL.

Adams *v.* Shaddock.

This case came on Tuesday last week before the Court of Appeal consisting of the Master of the Rolls and Lords Justices Romer and Mathew, on the appeal of the applicant from the award of the County Court Judge of Plymouth, sitting as arbitrator under the Workmen's Compensation Act, 1897.

Mr. J. Sankey said he appeared to support the appeal. The claim was by the applicant, a widow of the man killed, from a decision of the County Court Judge who decided the arbitration in favour of the respondents on two grounds. He first of all said that the man who was killed was not engaged in an employment to which the Act applied, and he then said that the respondents themselves were not "undertakers" within the meaning of the Act. The question raised a short point whether the deceased man was engaged "on, in, or about" engineering work. Engineering work within the Act meant any work of construction, repair or alteration of a railroad. The real question was whether the work the man was engaged on was the alteration of a tramway. If it was alteration of a tramway, he (counsel) should be right, and if not, his learned friend would be right. The respondent (the employer) was engaged in putting down at Plymouth the wires of the telephone company to connect the various private instruments with the Exchange, and to do that he had to open trenches in the various streets to put the wires into. One of the streets in Plymouth had electric tramways going along it. What was done was this. They made a trench from the side of the street up to the first rail of the tramway, and then made another trench between the two rails of the tramroad, and having made these two trenches, one on either side of the rail, it became necessary to poke a hole underneath the rail so that the wire might be placed through the hole underneath the rail so as not to disturb the tram passing backwards and forwards. The applicant's husband had assisted to dig the trench, and while he was making the hole underneath the rail in order to put the wire through, a tramcar came along and killed him. His contention was that the man was engaged on, in, or about the alteration of a tramroad, but the County Court Judge rejected that contention.

Lord Justice Romer: You altered the surface of the road?

Mr. Sankey: I say that the surface of the road, both under the Tramways Act and under authority is part of the tramway. They are the people who have to maintain it and have control of it. The tramway cannot be confined to the mere metals. As soon as the trench got within 18 in. of the outer rails it was part of a tramway?

Lord Justice Mathew: Supposing a man was employed filling up the trench between the rails and he was knocked down and killed, would he be held to be repairing the tramway?

Mr. Sankey contended that he would. The man was repairing a tramway immediately he began to fill up the hole.

At this stage the Court rose.

The hearing was resumed on Wednesday, November 1st.

Mr. Shakespeare, on behalf of the respondents, supported the decision of the learned County Court judge. The work which was being done by the applicant did not alter the tramway or interfere with it. The trams continued running the whole of the time, and, unless it could be shown that the Tramway Co. was *primâ facie* liable to repair the part of the road in question, the case for the applicant could not be just on any ground whatever. There was nothing in this case to show that there was a duty on the Tramway Co. to repair the road which lay between the two sets of metals. Under the Tramways Act, the duty of the company to repair that part of the road only arose where the two sets of tramlines were at a specified distance the one from the other. The opening of the intervening space between the two sets of tramlines had in this case nothing in the world to do with the Tramway Co. The Telephone Co. had power to do the work in question whether the Tramway Co. desired it or not. It was not putting a popular meaning upon an Act of Parliament to hold that this work constituted an alteration of the tramway, although the tramlines were not touched, and the traffic was not interfered with. There was no intention to interfere with the tramlines in any way, and "intention" was a matter which ought to be taken into consideration.

The Master of the Rolls in giving judgement, said this was one of those numerous conundrums that arose under the Workmen's Compensation Act, and he could not say that he had been able to form an at all clear or satisfactory judgement upon the matter, particularly in view of the fact that the Courts were not entirely at one upon the meaning of this definition. He had, however, come to a conclusion upon it, not that he was bound to say with any great certainty, because he did not think that this particular Act admitted of certainty in attempting to interpret its definitions. The applicant was in the employ of certain contractors, and in carrying out their undertaking, he had to take electric wires across and under the area of a high road occupied by tramlines under the statute. The point was whether the applicant in doing this work was engaged in engineering work. Under the Workmen's Compensation Act a definition of engineering work was "any work of

construction or alteration or repair of a railroad." In this particular case the work which applicant was employed to do, was not work which the owners of the tramway were concerned in. Applicant was employed by strangers, who had statutory rights to pass their wires across the tramway. He made a trench at right-angles to the line of tramway, and when he came within a short distance, about 1½ ft. from the line itself, instead of continuing the trench, he made a continuous small tunnel to admit of a wire being carried in it under the tramlines and the road space between the lines. When he came to the intervening space between the up and the down line, he made another trench, and his purpose was to pass the wire under the tramlines and so carry it across the whole of the roadway. That work undoubtedly did involve alteration of the physical condition of the surface of the roadway, between the up and down lines of the tramway. He had, in point of fact, to cut an opening in the road which was part of the high road, upon which the tramway was laid. The question was whether a person engaged in that work was engaged in engineering work—that was, in the work of construction or alteration or repair of a railroad. The Court had to apply the definition, and he thought they were justified, as far as it was possible to look at the scheme of the Act, which was to single out certain classes of employment and put certain persons engaged in such employment under the protection of the Act. It was obviously intended by the Legislature that there should be some distinction between different employments. It looked probable that there was some notion in this Act of Parliament of the different elements of danger in different employments, and those employments which were thought to have special elements of danger were brought within the Act. In dealing with engineering work, and looking at the definition "construction, alteration or repair of a railroad," it seemed to him the idea was that persons engaged in that work were subject to special risks. Obviously the governing notion was that that work was such as would bring the man employed on it into specially dangerous relations. Therefore, by whomsoever that person was employed, whether by the owner of the tramway or other persons, if he was engaged in work which entailed physical alteration in the railroad, he came within the line of danger, and required special protection. Here was a physical alteration made in the surface of the road along which a tramway was laid. The question was whether that could be described as alteration or repair of a railroad. The argument that the definition did not cover this particular work was mainly that the intervening space between the up and down lines of tramway being upon the high road was not part of a railroad within the meaning of the definition. Properly speaking, a railroad, when applied to one of those statutory tramways, such as the one in question, did not embrace the part between the rails, but must be limited to the rails themselves. Inasmuch as the surface upon which the tramway was laid was originally part of the highway, and remained the highway, it was originally repairable by the highway authority, and was now under statute only made repairable in the first instance by the Tramway Co., but leaving the underlying obligation to the highway authority to this extent that they were charged with the duty of themselves intervening. At all events, they had the right of themselves intervening and repairing if the tramway authority within a certain time neglected to do so. It was contended that that part intervening between the rails could not therefore be described as coming under the definition of a railroad, and that a person engaged in altering that part of the physical area could not be said to be engaged in the alteration of a railroad. His Lordship had come to the conclusion, not without hesitation and difficulty, that the definition must be taken to embrace work which was done in this particular case, and which undoubtedly did involve alteration of the physical condition of that part of the road where the tramway was laid. What did the word railroad embrace, taking the definition of railroad as expressed by the ordinary man in the street? There were a great many things called railroads quite apart from what the Court understood to be railways. It had been decided that having regard to the special definition of railways given in this Act tramways were included in it. They had been told by the House of Lords that as far as possible they should give a practical common-sense meaning to the different words used in the Act, and not to put any strained or artificial construction upon them. It seemed to him that the definition of the word railroad involved the use of the roadway as well as the iron rails on which the wheels ran. The whole thing, road and railway together, were embraced in the word railroad as applied to those tramways which were very common in particular colliery districts long before the ordinary street tramways were introduced. In dealing with such a tramway as that, it seemed to him that an alteration by any person who had undertaken to make it would be engineering work within the meaning of the definition in the Act. If, as here, there had been a contract by the undertakers to carry an electric wire across such a tramway or railroad, and that involved the digging of a trench in the roadway between rails, it seemed to him that that would be an alteration of a railroad within the meaning of the Act. It could not depend upon whether the Tramway Co. by the special terms of its existence was under obligation to repair that part or whether the obligation rested exclusively upon another person. That could not affect the question whether the particular subject matter embracing roadway as well as iron rails might fairly be described as railroad. If it could be so described, it did not matter on whom the obligation rested. The applicant, by virtue of his employment, was brought into juxaposition and placed on that thing which the Legislature deemed to be properly one of the class of things in respect to which there ought to be special protection. He was on engineering work, although the owner of the tramway was not the undertaker, but the person who employed him was undertaking the work which involved the physical alteration of what could be termed in popular terms a railroad. It seemed to him, therefore, that the learned judge had misdirected himself in this case by reference to special obligations imposed upon owners of railroads in the matter of repair. There was no evidence before the learned judge that this was not a railroad within the definition. Therefore the applicant was entitled to succeed.

Lord Justice Romer disagreed. He thought the County Court judge had come to a right conclusion. He did not see how the Court could, or ought to, differ from the County Court judge on the conclusion of fact he had come to. His Lordship thought it could not be said that because a tramway was laid upon a public highway under statutory authority, the whole of the public road became part of the tramway, so that every alteration of any part of the road was, as a matter of law, an alteration of the tramway within the meaning of the Workmen's Compensation Act, nor even if the road between the up and down lines of such a tramway had to be repaired by the tramway company—which, in fact, had not been proved in this case—would it, in his opinion, make the part of road between the two lines so much part of the tramroad that every opening effected in that road by a stranger to the tramways or any dealing with it would of necessity, and as a matter of law, be work falling within the definition of an alteration of the tramway. In considering whether an employment was one concerning the alteration of a tramroad within the Act, the matter should be looked at from what he might call a common-sense point of view. From that point of view he asked himself, was this workman employed in an alteration of the tramroad in any fair or reasonable sense of the term, as used in the Act? His Lordship could only say that in his opinion the workman certainly was not. No alteration of the tramway was contemplated or intended, and certainly on the evidence none was effected. The man was not employed to construct, to alter, or to repair the tramway. On the contrary, he was employed to do work about a telephone which in no way necessitated any alteration of the tramroad or the working of it. In his opinion there was ample evidence to support the finding of the County Court Judge.

Lord Justice Mathew supported the judgement given by the Master of the Rolls.

By a majority, therefore, the appeal was allowed.

A stay of execution was granted pending an appeal to the House of Lords.

Chitty *v.* the British Westinghouse Electric and Manufacturing Co., Ltd.

In the Court of Appeal on Monday, the Master of the Rolls and Lord Justice Mathew had before them the case of Chitty *v.* the British Westinghouse Electric Manufacturing Co., Ltd.

Mr. H. B. Matthews, who appeared on behalf of the plaintiff, Henry Chitty, said the point for their Lordships' consideration was what was the proper mode for the trial of this action. Lord Dunboyne ordered that the action should be tried by a special jury. Mr. Justice Bucknill reversed that order, and decided that the case should be tried by a Judge alone. Plaintiff was now anxious to restore Lord Dunboyne's order, his contention being that the action would be better tried by a special jury. The action was brought for damages for breach of an agreement of a somewhat singular character. The statement of claim referred to an indenture dated October 15th, 1902, made between the plaintiff and the defendants, and after reciting *inter alia* that the plaintiff was possessed of valuable technical information and knowledge in the construction of dynamo-electric machines in accordance with certain inventions of the plaintiff therein more particularly mentioned, and that such machines included certain further improvements invented by plaintiff, and reciting that the defendants had commenced negotiations with the plaintiff for the acquisition of his rights, interest and knowledge, or for making some arrangement with him with the view to manufacturing machines, and preparatory thereto, set forth that they had requested the plaintiff to give them an opportunity of investigating the matter and inspecting and testing the said machines which plaintiff had agreed to give them upon their giving such security against disclosure by them, their servants, workmen and others as was thereinafter provided; the plaintiff thereby covenanted with the defendants that he would allow them, or their experts appointed by them, to test the said machines, and the defendants thereby covenanted with the plaintiff that they, their successors or assignees and their servants, agents, experts, or nominees would not at any time thereafter, directly or indirectly, disclose or give information to any person whatsoever as to the said improvements, the method of construction of machines or any special technical information communicated or ascertained in the course of the investigation, and tests of the said machines or use the same in any way whatsoever. Proceeding, the learned counsel stated that plaintiff went to the works of the British Westinghouse Co. and took with him two experimental machines he had made. Those machines were subjected to certain tests, and the plaintiff's case was that in the course of that investigation and testing, and whilst he was at the plaintiff's works giving them the benefit of his technical knowledge and experience, he communicated to them in four particular respects, certain improvements in the method of constructing dynamo machines which, whether patentable inventions of his or not, were, at any rate, new to the British Westinghouse Co. The question to be tried was not a question for scientific investigation, or an issue such as would be raised in a patent action. It was purely a question as to good faith between the company and the plaintiff. Did the plaintiff, in fact, communicate to defendants certain improved methods of constructing machines which it was

admitted the defendants, after October, 1902, proceeded to manufacture by the thousand, and which plaintiff alleged incorporated the improvements he had communicated to the defendants. If the defendants had done that, and had practically thrown the plaintiff overboard, the question then was, did the defendants behave in accordance with the letter and spirit of the agreement? The matters in dispute in this case were clearly proper matters for trial before a special jury. Before plaintiff came on the scene, the defendants had not constructed machines showing any of the four different improvements which plaintiff said he had communicated to them. The defendants said that the plaintiff had not communicated to them anything that they did not know before he approached them. Although defendants admitted that they had changed the system of manufacture, they said that was in no way due to the communications plaintiff had made to them. The learned counsel afterwards read another paragraph of plaintiff's statement of claim, which was in these terms:—

"Previous to the plaintiff furnishing to the defendants designs for his new machines, the defendants had used cast-metal ventilating plates which were only partially effective. One of the improvements embodied in the plaintiff's design, and communicated to the defendants, was an improved method of making ventilating plates. The improvement consisted in part of making them of thin sheet-magnetic metal stampings, having little projecting pieces punched out for holding in place the ventilating vanes. In breach of the said agreement, the defendants have made a large number of machines with ventilating plates, in accordance with plaintiff's method of construction."

The Learned Counsel continuing, said in their defence the defendants denied that the plaintiff communicated any special technical knowledge to them, or that they had used any such knowledge for their own benefit. Such improvements defendants said, were well known to them prior to October, 1902, and were published and described. Another issue which had to be tried, dealt with the ownership of a certain motor, which was constructed by the defendants under a later agreement made in November, 1902. Plaintiff had been to the defendants' works, and after defendants had investigated the motors he had made, which were subject to the agreement of November, it was arranged that the defendants should construct, under the direction of plaintiff, another motor for the purpose of exhibiting some of the improvements he communicated to them. Plaintiff said there was a verbal agreement between defendants and himself that the motor so constructed was to be his property. The motor in its finished state was said to be worth £1,500. Defendants denied that such an agreement was made. They said that plaintiff was neither co-owner nor sole owner of the machine, that it was no good, and that it was only fit for scrap. There was nothing in the pleadings which a special jury could not deal with, and Counsel, therefore, submitted that the decision of Mr. Justice Bucknill ought to be reversed, and that the case should be heard by a special jury. The defendants had installed turbo-generating machines at the Savoy Hotel. These were most expensive and elaborate machines, and it was admitted that defendants were putting out by the hundred machines with improvements which plaintiff alleged he had communicated to the company. As to the measure of damages, Counsel suggested the fair way to look at that question was this:—"If you, the defendants, decided to adopt the devices and recommendations of plaintiff and kept faith with him, what sum of money would you have paid to procure a release from the covenants by which you were restrained from making use of his suggestions and knowledge." Such damages could more properly be considered by a special jury of business men than by a judge alone. Mr. Justice Bucknill was led away by the argument of Counsel for the defendants, that the recommendations and suggestions by plaintiff were not in truth and in fact patentable inventions. Upon the question of whether the improvements were new to the defendants when plaintiff approached them, a singular thing happened. Application was, in fact, made by the defendants themselves to patent one of the things. The application was made in Germany, but upon the German examiner pointing out that the specification had, in fact, been anticipated, the application for the patent fell to the ground. This incident would serve to show that the thing was not in truth a patentable invention, but it would be overwhelming evidence that the defendants had applied in respect of a thing with which they were made conversant by Mr. Chitty. The questions involved in the case were not questions of scientific investigation or research, which it would not be competent for a jury to deal with.

Mr. Graham, on behalf of the defendants, said the question involved was not one of good faith at all. Plaintiff went to the defendants and said he had made a number of inventions, which would be valuable to the defendants. The company said, "Very well, we will look into them"; they thereupon entered into the agreement with plaintiff. Defendants knew nothing at the time the agreement was made as to whether the things mentioned by the plaintiff were inventions or not. They took the plaintiff's word for it, but the defendants now said that the matters brought before them by the plaintiff were not new inventions. Defendants did not wish to be imperilled by the finding of a jury. The defendants contended that the agreement referred only to improvements which Mr. Chitty had invented, and that the things he showed them were all old. Some of the things were known at the time to be old, and others had since been found to be old. A jury was a very unsuitable tribunal for dealing with electrical matters, and the present case was one extremely unsuitable for trial by jury. Nobody ever heard now of patent cases, in which scientific evidence was to be made use of, being sent to a jury for trial.

Lord Justice Mathew: My experience unfortunately is different. I recollect having to try one or two patent cases with a jury at Birmingham, and somehow or other we got to an end of them. There were threats of appeal, but those threats were abandoned.

Mr. Graham said there were exceptions, but the bench and bar and everybody connected with such cases had long ago admitted that the proper tribunal to deal with them was a judge without a jury.

Lord Justice Mathew: There are two distinct issues here. First, as to the meaning of the contract, and second, as to whether the contract has been broken.

Mr. Graham said troublesome questions had to be tried in the case. The question of whether the inventions plaintiff claimed were old would sooner or later have to be decided, and that was a question a jury was very unsuited to try. Mr. Justice Bucknill was impressed by a paragraph in the claim which said:—"Besides the improved system of manufacture of ventilating plates communicated by the plaintiff to defendants, a feature of improvement in plaintiff's said two dynamo machines was the auxiliary poles and winding designed to effect sparkless commutation. Another improvement communicated by the plaintiff to the defendants, and introduced into the said motor constructed by them under the agreement of November 14th, 1902, was the method of preventing cross induction in the magnet-poles by the introduction of specially-shaped slots parallel to the axis of rotation. These features in combination peculiarly adapted the machines to fulfil the requirements of high speed." The learned counsel, proceeding, contended that this was besides an important matter to the whole of the directors of the Westinghouse Co., because Mr. Chitty had taken out a summons against the directors for contempt. The directors regarded this as very serious. Mr. Chitty went to the judge in chambers, and when he got there he turned tail and ran away, stating that he would let this question as to contempt follow the result of the trial in the present case. The directors of the company were all men of the highest position, and they did not want to have it left to a jury to say whether they were to be committed or not.

Lord Justice Mathew: I think the directors may have every confidence in the law of this country.

Mr. Graham: No doubt, my lord, but it is a very serious matter to have the question of whether the directors have committed contempt referred to the judge and jury who try the present case. Concluding, the learned counsel said that the defendants were going to call a great number of very eminent electrical engineers, and the case was one which would involve a great deal of expert evidence. The view the defendants took of the issue was not whether they knew of the invention at the time of the agreement, but whether the invention was that of Mr. Chitty.

The Master of the Rolls, in giving judgement, said: I am of opinion that the original order made by Master Dunboyne is the proper order in this case. It seems to me when you have a judge to construe the contract, the best tribunal for determining the issue of fact, in this case, is a special jury. It is not purely and simply a matter of technical patent law. There is a broad basis of common fact capable of being dealt with by ordinary people of intelligence and common sense, and I can conceive no better tribunal for dealing with that than a judge and jury. In my opinion there is no ground for interfering with the view taken by the learned Master. I do not think that the technical difficulties suggested in the paragraphs read are typical of the sort of thing which has to be overcome. I do not see any ground for suggesting that the jury will be confounded by these difficulties. They are no more than the ordinary difficulties to be met with in cases where technical terms have to be overcome. When the technical terms are explained by those who understand them, the matter becomes one of pure every-day fact. A special jury would very probably embrace persons who are cognisant with those matters, and who would be quite as competent to decide it as any of the judges. I am, therefore, of opinion that the appeal ought to be allowed.

Lord Justice Mathew concurred.

The appeal was accordingly allowed, the Master's order for a trial by special jury restored, and the costs of the appeal made costs in the cause.

Bainbridge and Another *v.* His Majesty's Postmaster-General.

This case came before the Court of Appeal consisting of the Master of the Rolls and Lord Justice Mathew on Monday, on the appeal of the Postmaster-General from an order of Mr. Justice Walton in Chambers.

The Attorney-General, in opening the case, said the question for decision was whether the Postmaster-General was liable to be sued *in tort* in his corporate capacity. He asserted that he was not, and was not liable at common law, and that there was nothing in the statutes which made him for this purpose a corporation or which imposed upon him any liability to be sued. The action was one brought in respect of injuries sustained by the plaintiff, Elizabeth Bainbridge, by reason of the alleged defective execution of works connected with the laying of telephone lines. The action was originally commenced against Mr. Crane, the district engineer, alone, he being in charge of the work. But a summons was taken out before the Registrar to add the Postmaster-General as a party generally. The application was to add the Postmaster-General by name, but although the Registrar did not make the order in that form, he did add the Postmaster-General as such. The Postmaster-General then took out a summons to have that order disallowed. The matter came before Mr. Justice Walton in Chambers. Mr. Justice Walton said that the question was one of difficulty, and it did not seem

to him to be a matter to be determined on summons. His Lordship refused to strike out the name on the summons, but gave leave to appeal from his order. The matter, therefore, came before their Lordships. He (the learned Attorney-General) submitted that the matter had to be dealt with at this stage, and that the Postmaster-General was not competent to be a party to the action. The position of the Postmaster-General at common law was perfectly clear. He was the head of a Government department, and neither he nor the head of any other Government department was liable to be sued for the default of his subordinates.

Mr. Smith, for the plaintiffs, supported the decision of Mr. Justice Walton. He submitted that the plaintiffs were entitled to join the Postmaster-General in his corporate capacity. Of course it was not desired to make him liable in his private capacity.

The Attorney-General having briefly replied,

The Master of the Rolls said that as the point raised was an important one, the Court would take time to consider its judgement. Judgement was accordingly reserved.

Private-Wire and Telephone Installation Co. *v.* Portman and Co.

On Friday in the Westminster County Court, Judge Lush-Wilson, K.C. (sitting for Judge Woodfall), had this case before him. It was a claim for £30, rent and hire of a private instrument.

Mr. Hodges, for plaintiffs, said the Consolidated Telephone Co. assigned this installation to plaintiffs, and the assignment was notified to the defendants. There were four private lines between defendants' offices in the Adelphi to the Strand, Regent Street and Sussex Mews, Maida Vale. Defendants had paid amounts to plaintiffs since the assignment, but declined to pay the present amount due and also filed a counterclaim, the nature of which he would leave to his friend, Mr. Simmonds. The action had been remitted from the High Court.

Evidence was given in support, and it was admitted in cross-examination that plaintiffs had no licence from the Postmaster-General. There had been complaints about the telephone, and they had been attended to.

Mr. Simmonds, for defendants, submitted there was no case, as plaintiffs had contravened Secs. 4 and 6 of the Telegraph Act, 1869, telephones coming within the meaning of that Act, as it had been held a telephone message was a telegram.

The Judge remarked that in this case the telephones were used exclusively by defendants.

Mr. Simmonds: Plaintiffs' managing director admitted in cross-examination that others used them.

Mr. Hodges disagreed. Plaintiffs only knew the defendants in the matter, although other persons in the same buildings might have used them.

The Witness, recalled, declared he had no idea that anyone but defendants used the telephones.

The Judge: You (defendants) dealt with the Private Wire and Telephone Installation Co.

Mr. Simmonds: I don't suppose defendants gave that a thought.

Mr. Hodges complained that a statutory defence had not been filed.

The Judge: It is hardly fair to spring it on the Court.

Mr. Simmonds: I did not know this until two hours ago.

The Judge suggested an adjournment, and remarked he was rather in a difficulty, as plaintiffs were only assignees after the lines had been put up.

Mr. Simmonds thought that made no difference, as they had not the Post Office licence.

Mr. Hodges: The point has not been raised in a case before. The whole of the line was for one subscriber.

The Judge: Why should not plaintiffs recover?

Mr. Simmonds: Because it is an unlawful contract. There cannot be a legal claim under an illegal contract.

The Judge: Notice of this defence ought to have been given.

Mr. Simmonds repeated he had only known of it two hours before, and if it was considered the proper thing to do, he would ask for an adjournment to give notice.

The case was accordingly adjourned.

Charters & Thornton *v.* Bristol Tramways and Carriage Co., Ltd.

This case came before the Lord Chief Justice and Justices Wills and Darling, sitting as a Divisional Court on 6th inst., on an appeal by the plaintiffs from a decision of County Court Judge Austin, sitting at Bristol.

The plaintiffs asked that the judgement of his Honour be set aside, and judgement be entered for plaintiffs for £51 14s. 4d. on the grounds that he had misdirected himself, that he had wrongly admitted evidence as to an alleged parole warranty by plaintiffs outside the terms of the written contract, and that the words imputed to plaintiffs did not amount to a warranty.

Mr. Inskip, for the plaintiffs (a Manchester firm), said that the article in dispute, called "Smooth-on," was an American patent enclosed in tins, and was sold by Thornton to the defendants' engineer for filling up spaces between electric standard posts and the bases. There was a written order which contained no warranty, but there was also a conversation, in which the engineer asked Thornton if he would guarantee that the stuff would set. Thornton replied, "It will set." This the Judge held to be a warranty, and he further found that the stuff, which failed to set, was worthless for the purpose for which it was sold.

Counsel argued that the Judge was wrong, but the Court, without calling on counsel for the defendants, dismissed the appeal, with costs.—*Bristol Echo.*

NEW ELECTRICAL DEVICES, FITTINGS AND PLANT.

(*Continued from page* 744.)

Magnetic Motor-Starter.

A novel type of motor-starter and regulator, called the "Stellite-Gradual," has been introduced by the Electric and Ordnance Accessories Co., Ltd., and is illustrated herewith (fig. 99). Its action is as follows:—The loose arm carrying the pot magnet is moved towards the switch arm, and, the shunt circuit being completed when near the latter, the magnet holds the switch arm; the handle can then be moved forward to start the motor slowly. When full speed is attained, the switch is in position for speed regulation. If the

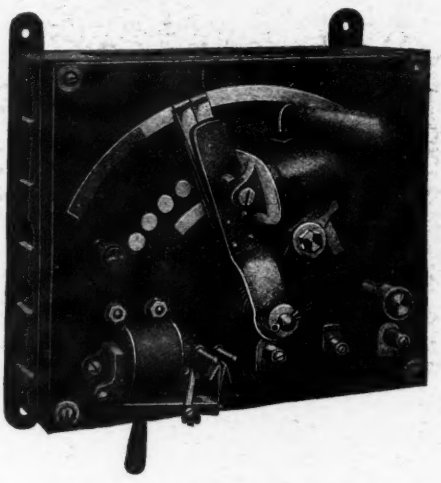


Fig. 99.—The Stellite-Gradual Motor-Starter and Regulator.

operator starts the motor too quickly, the excessive current in the armature circuit trips the overload coil and de-energises the pot magnet, thus allowing the switch arm to fly back to the "off" position.

A starter without regulation is also made on the same lines, in which the switch can be left in the "full on" position only. In the event of an overload, or no-voltage, the switch arm immediately returns to the "off" position. The apparatus is made up to 500 volts and 50 h.p., and the larger sizes are provided with renewable contacts.

Ironclad Switches.

Messrs. A. Seage & Co., manufacturing electrical engineers, of Cambridge Works, Hammersmith, W., are making a line of double pole "Glasgow" switches (fig. 100) in cast-iron cases for pressures up to 600 volts, such as they have made specially for the purpose of meeting the rules of the Glasgow Corporation for their 500-volt circuits. The box is lined throughout with stout asbestos. The poles are connected by means of a substantial hard black vulcanised fibre connecting bar, and the handle is made from the same material. The switch has a very long and extremely rapid break, and it is impossible for the blades to be left in an intermediate position between "on" and "off." No iron parts are used in the construction of the switch, the only metals used being copper, gun-metal and brass. The blades and contact jaws are made from hard

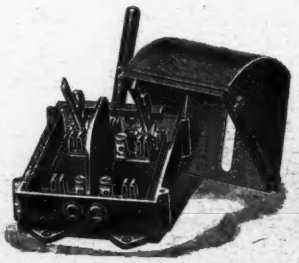


Fig. 100.—Glasgow Switch.

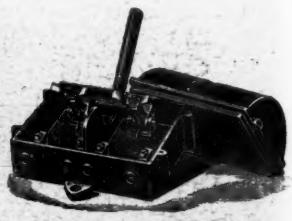


Fig. 101.—The "Y" Switch.

drawn h.c. copper, the jaws being very springy to counteract any wear which takes place. The pedestal supporting handle lever is separate from the contact blocks, and when the switch is open the entire switch parts are "dead" with the exception of the supply terminals. The contact surface is very large, giving approximately 100 amperes per sq. in.

Fig. 101 shows the firm's double pole laminated "Y" switches in cast-iron cases (lined with asbestos) for pressures up to 400 volts. Each pole is carried on a separate paraffined slate, and is insulated

from the case by means of ebonite bushes. Adjoining poles are protected by a stout fibre dividing fillet, extending almost to the top of the case, thereby ensuring a maximum of distance between the poles. No metal is used in the space between the poles. The switch has a very powerful spring action, ensuring a quick break.

The brush consists of a number of layers of H.C. copper, and is easily adjustable by means of a "wedge" adjustment to regulate the pressure upon the contacts, and for taking up wear. The final break does not take place on the main contact surface, but the arc is confined to points not in use when the brush is forced home. The contact blocks are hard drawn brass, and no castings are used in current carrying parts, which are designed with a maximum current density equivalent to H.C. copper at not more than 500 amperes per sq. in.

New Instruments.

Messrs. Evershed & Vignoles, Ltd., have recently placed on the market a leakage indicator for D.C. two-wire wholly-insulated circuits, intended to fulfil as nearly as possible the Home Office

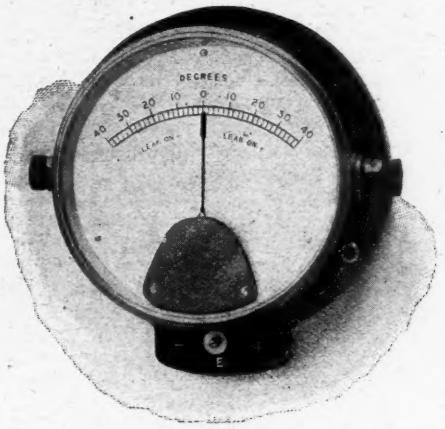


Fig. 102.—Evershed Leakage Indicator.

Rules for the use of electricity in mines. The connections of the instrument, and the indicator itself, are shown in the accompanying figures, Nos. 102 and 103; the instrument is permanently in connection with the mains, and indicates at once the presence of any serious difference between the insulation resistances of the latter. By pressing each key in succession, two readings are obtained, from which, with the aid of a table, the respective insulation resistances and the leakage current can be obtained. New moving-coil instruments have also been brought out by Messrs. Evershed & Vignoles, of the sector type, for central station switchboards; the round type, and the portable type. The round type is now made only in one size, having a dial 8 in. in diameter; the ammeter terminals have tubular ends, into which the leads from the shunt must be soldered, thus abolishing the errors due to screwed connections—the leads being soldered to the shunt also.

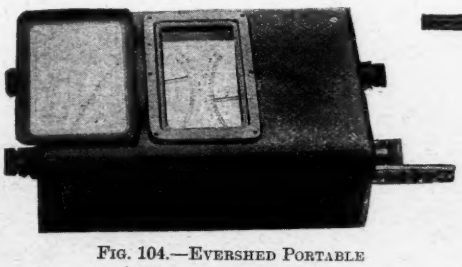


Fig. 104.—Evershed Portable Ammeter and Voltmeter.

Of the portable instruments, we have selected a combined ammeter and voltmeter for illustration (fig. 104). This instrument is arranged with two movements at the ends of a common magnetic circuit, and the pointers work over separate scales on a common dial, so that both instruments may be used simultaneously. The ranges are respectively from 0·001 ampere or volt (1 division) to 1,000 amperes or volts, and therefore from one-millionth of a watt to 1,000,000 watts (the makers state the lower limit as ·01 v. × ·01 a. = ·0001 watt, but we fail to see the reason); the combination can also be used to measure resistances from one-millionth of an ohm to one megohm directly, and even higher values indirectly. This enormous range, it will be noticed, places such a combination as this, regarded as a physical measuring instrument, in a class by itself. Without estimating fractions of a division, it is possible to cover a range of resistances extending from 1 to 1,000,000,000,000

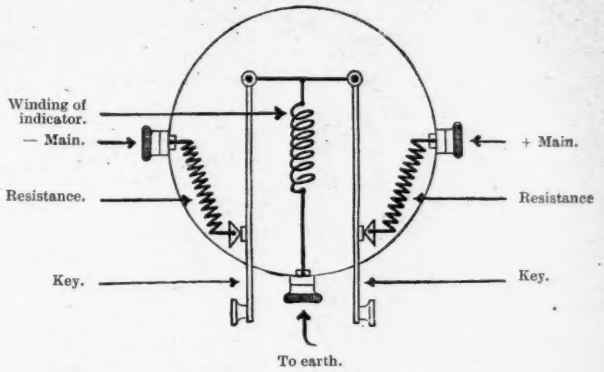


Fig. 103.—Connections of Leakage Indicator.

microhms or microwatts. What other type of instrument in existence approaches this enormous range? Moreover, by estimating to $\frac{1}{10}$th of a division—an easy thing to do—the range can be increased a hundred-fold, and yet this apparatus can be carried about, weighing in leather case 25 lb.

The B.T.H. Flexible Suspension Ear.

This new suspension ear (fig. 105) has been introduced by the British Thomson-Houston Co., Ltd., Rugby, for overcoming various objections to the present form of soldered ear or rigid form of mechanical clamped ear.

The clamps for the wire are so supported as to allow practically free movement in any direction without producing unnatural curves or abrupt bends, while preserving an even path for the trolley wheel and firmly supporting the wire in position. The upward movement of the wire and clamps, which is caused by the trolley wheel in passing under the ear, is practically parallel, and since the clamps are capable of a limited longitudinal displacement on the supporting bar, the wire takes up a natural curve, in which there are no abnormal stresses in any part of its section.

Among other things, it is claimed that this form of suspension obviates the objectionable hammer blow which takes place when the trolley wheel passes on to a suspension ear of the ordinary rigid type, thus conducing to smoother running of the trolley wheel, and minimising repairs to the trolley head. The B.T.H.

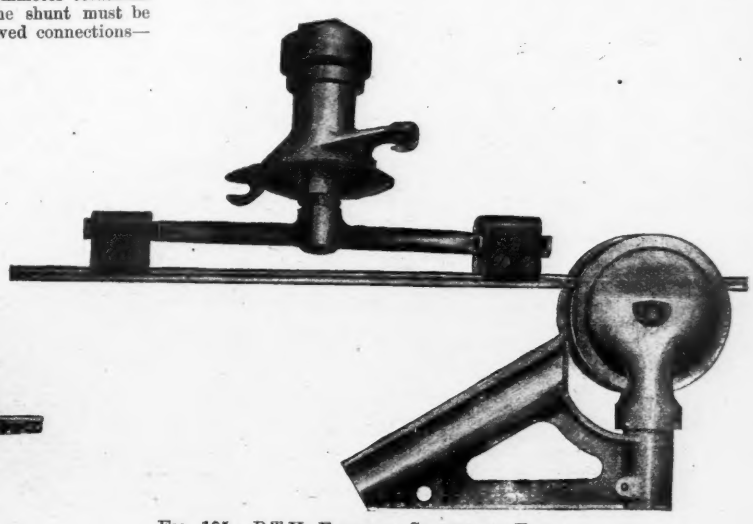


Fig. 105.—B.T.H. Flexible Suspension Ear.

flexible ears are supplied in two grades:—Mild steel drop forged body with drop forged clamps, and mild steel drop forged galvanised body with gun-metal clamps.

Tubular Fuses.

We illustrate herewith the standard designs of tubular fuses made by Messrs. A. Reyrolle & Co., Ltd., of Hebburn-on-Tyne. These fuses are made in all sizes from

25 amperes to 600 amperes, for use on 500-volt circuits. There is a point about the construction of these fuses which should be mentioned, and in the line drawing (fig. 106) the construction in section is shown, from which it will be seen that there are two thick asbestos tubes A and B inside the porcelain handle. The

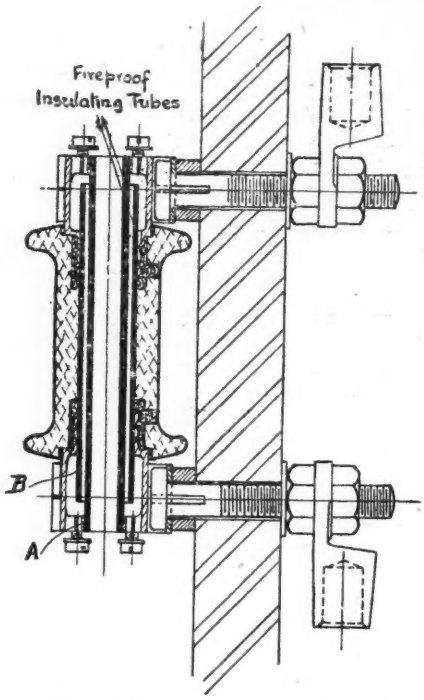


Fig. 106.—Sectional View of Tubular Fuse.

internal tube A surrounds the fuse-wire, and is very effective in causing the arc to be blown out when the fuse melts on a dead short. The external tube B is provided in order to keep the porcelain handle cool, and it will be seen from the illustration that an air-gap is contained between these two tubes. Ventilating holes are

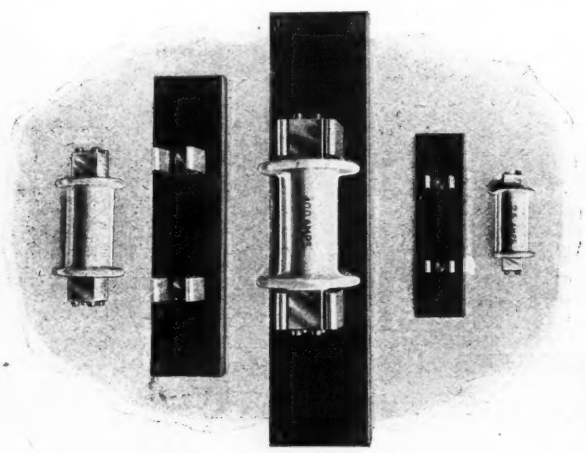


Fig. 107.—Tubular Fuses.

provided in the metal contacts on each end, and by this means the heat, which must of necessity be generated on a fuse, is dissipated, and, keeping the porcelain cool, minimises the risk of breakages. The material used for the fuse is bare tinned copper wire, and cheese head terminal screws and washers are provided on each end of the holder so that the holder can be re-fused quickly and cheaply.

(To be continued.)

Cape Town.—A deputation from the South African College Council waited upon the City Council on the 12th ult. to lay an appeal before the city for the endowment of a chair of electro-technics in connection with the engineering section at the College. After an animated discussion, in which the question of the admission of coloured students to the College was somewhat excitedly debated, it was resolved by 12 votes to 5 that the necessary grant be made.

ELECTRIC LIGHTING COMPANIES AND COMPULSORY PURCHASE.

[By Our Legal Contributor.]

(*Concluded from page* 740.)

In valuing the undertaking of an electric lighting company, the following are to be taken into account:—The value of all lands, buildings, works, materials and plant suitable to, and used for, the purposes of the undertaking. "Value" means fair market value at the time of the purchase, due regard being had (*a*) to the state of repair (*b*) to suitability (*c*) to the fact that they are ready for immediate working.

Careful consideration of these words shows that undertakers may, in certain conditions, obtain little more than old iron prices for their stock in trade. No additional 10 per cent. is payable as compensation for compulsory purchase: seeing that they undertook the supply of electricity with full knowledge of this fact, it can hardly be made the subject of complaint at the present time. But assume that when the day for compulsory purchase arrives, the undertakers are provided with superannuated plant in a bad state of repair. While the arbitrator is bound to give weight to the fact that the plant is ready for immediate working, he is also to have regard to suitability, and in the then circumstances, the plant may be entirely unsuitable. It is conceived, however, that although (to quote further terms of the section) he may not make any addition for "goodwill, or for any profits which may or might have been or be made from the undertaking," he may consider what it would cost to establish the undertaking if it did not then exist. We may refer once more for help upon this point to the case of the London Street Tramways Co. *v.* London County Council (*ubi supra*), where it was decided that the word "tramway" meant the structure laid down and nothing more, and did not include the statutory powers conferred on the company; and that the arbitrator was right in rejecting all evidence of past and future profits, including evidence of the rental value of the tramways considered as let or capable of being let to a tenant, and in awarding that "the then value of the tramway and all lands, buildings, works, &c., must be measured by what it would cost to establish the tramway if it did not then exist, subject to a proper deduction in respect of depreciation. In one important particular, however, the words of the Electric Lighting Act differ from those of the Tramway Act. In the case of an electrical undertaking regard must be had to the fact that the plant, &c., is in such a position as to be ready for immediate working.

Seeing that in order to acquire the right to instal plant for the purpose of supplying electricity to the public, the undertakers were compelled to go to the expense of obtaining a provisional order or special Act, it may become a question whether they are not entitled to bring some part of such expenses into account. Test it in this way: If a local authority were desirous of undertaking the supply of electricity, they would be compelled to incur the cost of a provisional order. Why should they, merely in virtue of their right of compulsory purchase, obtain the advantages of a provisional order for nothing? This is a question which is sure to be raised when the day of compulsory purchase arrives, and local authorities are in arbitration with supply companies throughout the land.

One other provision in the section deserves consideration. It is provided that where a part only of the undertaking is purchased, regard is to be had to any loss occasioned by severance. For instance, take the case of a supply company whose distributing area extends into several Local Government districts. One local authority may desire to purchase that part of the supply company's undertaking which is in their district. In such a case compensation shall be paid for severance. No such case is likely to arise in the metropolis, inasmuch as the dates when compulsory purchase is permissible will coincide; but the occurrence of a "severance" is within the bounds of possibility in other parts of the country, and even in the metropolis it is not certain that every local authority will desire to exercise the right of compulsory purchase.

The foregoing is an outline of the existing law as it affects compulsory purchase. It must not be supposed, however, that persons interested in the supply of electricity have accepted and recognised their position without protest during all these years. So far from accepting it, they have urged some modification of the law, and, as a result of their protests, at least two Bills (those of 1903 and 1904) have been brought before Parliament with a view to obtaining some alteration of the law of compulsory purchase in future provisional orders. That these Bills received departmental support may be inferred from the fact that they were both classed as Government Bills; and it is quite possible that, before the expiration of the statutory period, the Board of Trade may be empowered to modify the terms of compulsory sale. Clause 3 of the Supply of Electricity Bill, 1903, was in the following form:—(1) The Board of Trade may by provisional order exclude the application of the power of purchase given by Sec. 2 of the Electric Lighting Act, 1888, in the case of any undertaking to which they consider it is inapplicable, either by reason of the undertaking being situate in a large number of districts, or by reason of the objects of the undertaking not being such as can be properly carried out by local authorities, or by reason of any other special circumstances affecting the undertaking, but before doing so shall cause notice to be given to any local authorities who would have the right to purchase under the said section, and shall consider any objection made by any of those authorities. (2) The power of the local authority to purchase an undertaking under Sec. 2 of the Electric Lighting Act, 1888, both as respects undertakings authorised before the passing of this Act, and as respects undertakings authorised after the passing of this Act, (*a*) shall extend so as to authorise the purchase of any generating station, mains or other works used solely for supplying electricity for the purpose of the undertaking, notwithstanding that the station, mains or works are situated outside the area of supply, or outside the district of the local authority; but (*b*) shall not extend so as to authorise the purchase by a local authority of any generating station situated in their district which is not used for the supply of electricity within some part of the district. The fact that a clause in the above form has found a place in a Government measure appears to be an admission that the policy of wholesale municipalisation has been examined, and found wanting.

While dealing with the question of compulsory purchase—and, in particular, having regard to the somewhat meagre compensation which will become payable at the end of the statutory period, it may be well to remind electrical undertakers that it is open to them to negotiate for the sale of their undertakings to local authorities upon terms which may differ from those prescribed in Sec. 2 of the Electric Lighting Act, 1888. Sec. 3 of that Act provides that, "Notwithstanding anything in the last preceding section contained, the Board may by any provisional order to be made by them under the Electric Lighting Act, 1882, if they think fit, vary the terms upon which any local authority may require the undertakers to sell, and upon which the undertakers shall be required to sell to such local authority their undertaking, or so much of the same as is within the jurisdiction of such local authority under the said section, in such manner as may have been agreed upon between such local authority and the undertakers." Does this section enable a local authority and a company to enter into negotiations for purchase before the expiration of the statutory period? It is conceived that it does: and instead of purchasing new and expensive plant of which they may be compulsorily deprived, it might be well worth while for a company to approach the local authority before the expiration of this period, in order if possible to negotiate for the sale of their business as a going concern.

Electricity in a Portuguese Mill.—It is reported that the contract for the electrical equipment of the first sewing-cotton mill so equipped in Portugal has just been awarded to the Brush Electrical Engineering Co. The equipment includes 43 motors and a turbine alternating current set, all of Brush manufacture. It is stated that this will be the first steam turbine to be erected in Portugal.

OUR LEGAL QUERY COLUMN.

[Questions addressed to the Editors for insertion in this column should be written on one side of the paper. Free use of fictitious names, &c., may be made. Answers are furnished by a duly qualified lawyer, but the Editors cannot undertake to be responsible for the accuracy of the views which he may express.]

"A, B and C" writes:—"A customer of ours proposes to run a pair of overhead cables from the works (which are those of a private limited company) to his residence, and must cross a public road. Shall we have to obtain the Urban District Council's consent before crossing the road, or can we cross at a certain height with their consent? The District Council have got a provisional order to supply electric light but have not yet put same into use. We trust that we are not trespassing on your valuable space, but we think that same may be of use to your numerous subscribers, now that numerous Urban Districts are taking out provisional orders, and that electric light is coming into general use throughout the country."

*** The question addressed by "A, B and C" is not one which can be answered without further information as to the powers of the Urban District Council in the district. It may be stated, however, that the fact of the District Council undertaking the supply of electricity in their district has no bearing upon the case. "A, B and C" have a right to supply electricity to whom they will. The question whether, in their capacity as highway authority, the Council can prevent the erection of the wires depends upon a variety of considerations. (1) If they have adopted the Public Health Acts Amendment Act, 1890, they can insist that such wires shall only be put up in accordance with their regulations; (2) if they have *not* adopted the P.H.A.A.A., 1890, but own the soil of the highway, they may object to any wires being placed across the road; (3) if the land on either side of the road is in private hands it is quite possible that "A, B and C," by private agreement, might be able to suspend the wires without obtaining any leave As the matter may lead to difficulty—and if it is worth while—it is suggested that counsel's opinion should be taken. Proper investigation of the rights and powers of this particular Urban District Council would be necessary.

"Property Owner" writes:—"I should feel obliged if, through the medium of your valuable paper, I could get some reliable information as to liabilities incurred in connecting up two electric light consumers from one service cable, in cases where the premises adjoin, and there is only the dividing wall between the two-meter positions.

"I am connected with a house that has been supplied in this manner, that is, the source of supply reaches the meter through a service cable laid in the house adjoining, and the connecting wires are laid in iron pipes through the dividing wall just below the floor joists.

"Have I power to demand the supply company to put me in a separate service, and how should I stand with regard to the Insurance Co., with whom my premises are insured?"

*** It is not quite clear what "liabilities" are referred to by "Property Owner" in the first half of the above question. Every consumer is entitled to have a supply of electricity upon terms which must not be less beneficial than the terms upon which another consumer in the same district is entitled to have a corresponding supply. It would seem clear from this that subject to any special term in the provisional order under which electricity is supplied in "Property Owner's" district, he may demand a separate supply. As to insurance, this question cannot be answered without reference to the terms of the policy.

NEW PATENTS APPLIED FOR.

Compiled expressly for this journal by W. P. Thompson & Co., Electrical Patent Agents, 322, High Holborn, London, W.C., and at Liverpool, to whom all inquiries should be addressed.

21,204. "Improvements in apparatus for moving electrically the points on electric tramways and railways." J. P. Tierney and J. Malon. October 19th.

21,223. "Improvements in electric stop motions." A. G. Brown, A. W. Brown and E. C. Whelan. October 19th.

21,224. "Improvements in conduits for electric cables and the like." The Simplex Steel Conduit Co., Ltd., F. Huggins and L. M. Waterhouse. October 19th.

21,228. "Improved form of high-tension distributor." S. A. Horstmann. October 19th.

21,248. "An electric machine for use in automobiles and for other purposes." J. A. E. Pellorce. October 19th.

21,258. "Improvements in dynamometric governors." J. O. Richardson. October 19th.

21,260. "Improvements in switch stands." F. W. Snow. (Date applied for under Patents Act, 1901, December 15th, 1904, being date of application in United States.) October 19th. (Complete.)

21,261. "Improved arc lamp suspender." J. Ruddick and H. E. Fry. October 19th.

21,264. "Improved construction of accumulators or secondary batteries." A. E. Dakhyl, A. Galanti and H. N. Dakhyl. October 19th.

21,268. "Improvements in or connected with magneto-electric apparatus for igniting the charge in internal combustion motors." M. de Saint-Romain. (Date applied for under Patents Act, 1901, April 27th, 1905, being date of application in France.) October 19th. (Complete.)

21,279. "Improvements in electric batteries." A. J. Fippard. October 19th.

21,289. "New or improved apparatus for indicating and obviating leakage from conductors or electricity." J. M. Moffat, R. J. Bott, J. W. Manley and The Electric Safety Appliances Co., Ltd. October 19th.

21,386. "Improvements in or relating to electric lamps of the character known as vapour lamps." R. F. Venner. October 21st.

21,391. "Electro-deposition of zinc." J. Swinburne. October 21st.

21,439. "Improvements in and relating to electric switches." The British Thomson-Houston Co., Ltd., and E. B. Wedmore. October 21st.

21,444. "A new or improved electro-magnetically operated heat supply valve for heating and ventilation." F. Kaeferle. (Date applied for under Patents Act, 1901, July 17th, 1905, being date of application in Germany.) October 21st. (Complete.)

20,951. "Improvements in electric elevator control systems." Otis Elevator Co., Ltd. (Otis Elevator Co., United States.) October 16th. (Complete.)

17,402a. "Improvements in electric switching apparatus." H. Stern and G. Engisch. (Date applied for under Rule 5 of the Patents Rules 1905, August 28th, 1905.) October 26th. (Complete.)

21,466. "Carbon holder for arc lamps." H. E. Moul. October 23rd.

21,470. "Thermo cut-out." J. Skwirsky. October 23rd.

21,474. "Improved means of electric ignition for gas and oil engines." J. Edmonds, J. A. Edmonds and S. Edmonds. October 23rd.

21,478. "Improvements in electrical terminals and connections." A. J. Downes. October 23rd.

21,480. "Improvements in electrical ignition devices for internal combustion engines." H. C. L. Holden. October 23rd.

21,485. "Improvements in electrical switches." The Electric and Ordnance Accessories Co., Ltd., and R. F. Hall. October 23rd.

21,487. "Improvements in letter box plate for letter box and electric bell push combined." D. Timmins. October 23rd.

21,519. "Improvements in supports for electric incandescent lamps." M. A. Cox. October 23rd.

21,521. "Improved coil trembler for electrical ignition apparatus of high-speed engines for motor-cars and similar vehicles." S. J. Williams. October 23rd.

21,523. "Improved form of prepayment electricity meter." H. F. J. Thompson and J. H. Bowden. October 23rd.

21,533. "Improvements in the manufacture of active iron mass for the electrodes of alkali-accumulators." E. W. Jungner. October 23rd.

22,534. "Improvements in the manufacture of electrodes for electrical accumulators by means of continuously operating machines and in the electrodes and accumulators thus manufactured." E. W. Jungner. (Date applied for under Patents Act, 1901, June 10th, 1905, being date of application in Sweden.) October 23rd. (Complete.)

21,535. "Improvements in or relating to insulation for accumulators with alkaline electrolyte." A. E. Berglund. (Date applied for under Patents Act, 1901, March 15th, 1905, being date of application in Sweden.) October 23rd. (Complete.)

21,565. "Improvements in telephonic apparatus." J. D. F. Andrews. October 23rd.

21,581. "Improvements relating to trolley poles of electric tramcars or the like." J. H. Collie. October 24th.

21,583. "Automatic starting resistance for electrical motors." E. Bolton. October 24th.

21,615. "Improvements in or in connection with the cells of electric accumulators, applicable also for other purposes." A. Battersby. October 24th.

21,641. "Improvements in ignition devices for combustion engines." J. Kritzler. October 24th. (Complete.)

21,642. "Improvements in and connected with igniting mechanisms for internal combustion engines." J. Kritzler. October 24th. (Complete.)

21,643. "An improved method and means for insulating the sparking plugs of internal combustion engines." J. Kritzler. October 24th. (Complete.)

21,652. "Improvements relating to electric motors." H. H. Lake (International Holding Co., United States.) October 24th. (Complete.)

21,658. "Improvements in or relating to electric motors, dynamos, electro-magnets and other machines or apparatus comprising an electrically produced magnetic field. A. Vedrine and Count Raoul de Quelen. (Date applied for under Patents Act, 1901, October 25th, 1904, being date of application in France.) October 24th. (Complete.)

21,659. "Improvements in electric road motor-vehicles." A. Vedrine and Count Raoul de Quelen. (Date applied for under Patents Act, 1901, October 26th, 1904, being date of application in France.) October 24th. (Complete.)

21,661. "Improvements relating to sound boxes for phonographs, telephones, and the like." P. Lebiedzinski. October 24th. (Complete.)

21,672. "Improvements in and relating to electric meters." Allgemeine Elektricitats-Gesellschaft. (Date applied for under Patents Act, 1901, October 28th, 1904, being date of application in Germany.) October 24th. (Complete.)

21,675. "Improvements in systems of electric motor control." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) October 24th.

21,681. "Improvements in electric shunts." H. S. Hatfield and F. M. Lewis. October 24th.

21,682. "A new or improved table for Röntgen ray work." E. Parker. October 24th.

21,683. "A new and improved mechanism in connection with prepayment electricity meters. F. H. Merritt. October 25th.

21,700. "An improved connecting joint for the sections of drain cleaning tools, chimney cleaning brushes, pulling through rods for electrical conduits, fishing rods, sword sticks and the like." G. Davis, W. Davis and S. Davis. October 25th. (Complete.)

21,707. "Protecting device for shunt field windings of electrical machines where shunt regulators are used." T. Edge. October 25th. (Complete.)

21,739. "Improvements relating to electric heating or cooking apparatus." J. S. Highfield. October 25th.

21,752. "Improvements in or relating to mechanism for making and breaking electric circuits in connection with alarm clocks, tell-tale clocks and the like." F. Kuhn. October 25th.

21,753. "Improvements in and relating to electric resistances." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) October 25th.

21,761. "Improvements in and relating to electric conductor rail insulators." W. V. Bonsor. October 26th.

21,795. "Improvements in or relating to electrically synchronised clocks." F. A. Chandler and B. Bonniksen. October 26th.

21,798. "Improved system of armoured insulated conduit for running uninsulated electrical conductors." H. H. Clements. October 26th.

21,804. "A new or improved vacuum receptor or apparatus for the production of violet or ultra-violet rays, X-rays, or other rays or combinations of rays by induction on two-tension currents." J. H. Phelps and J. C. Bowie. October 28th.

21,833. "Improvements in electro-magnetic apparatus." J. McIntyre. (Date applied for under Patents Act, 1901, October 29th, 1904, being date of application in United States.) October 26th. (Complete.)

21,834. "Improvements in Ruhmkorff coil." J. McIntyre. (Date applied for under Patents Act, 1901, December 8th, 1904, being date of application in United States.) October 26th.

21,846. "Improvements in and relating to electric telegraphy." A. C. Baronio and A. Muirhead. October 26th.

21,850. Improvements in or relating to service apparatus for electric supply." W. M. Mordey and G. C. Fricker. October 26th.

21,851. "Improvements in or relating to alternating-current motors." W. A. Dutton and The Brush Electrical Engineering Co., Ltd. October 26th.

21,855. "Improvements in electric power measuring and recording instruments for alternating currents." V. Arcioni. (Date applied for under Patents Act, 1901, October 27th, 1904, being date of application in Italy.) October 26th. (Complete.)

21,856. "Improvements in electric clocks." G. B. Bowell. October 26th.

21,870. "An improved method of securing or attaching a wire supplying electricity to a terminal." A. A. Lines. October 27th.

21,882. "Improvements in electrically-driven bicycles and the like vehicles." S. H. Parry and H. Barrett. October 27th.

21,898. "Improvements in or relating to means for releasing pawl-locking devices in telephone instruments and the like." M. Baumer. October 27th.

21,931. "Improvements in electric arc lamps." The British Thomson-Houston Co., Ltd. (The General Electric Co., United States.) October 27th.

21,947. "Improvements in and relating to dynamo-electric machines." S. von Ammon. October 27th.

21,949. "Improvements relating to the manufacture of hypochlorite solution by electrolytic methods." W. P. Digby. October 28th.

21,975. "Improvements connected with the supporting and mounting of the shafting of ships and analogous telegraphic apparatus." A. J. Grant. October 28th.

22,005. "Improvements in insulated electric conductors." W. T. Henley's Telegraph Works Co., Ltd., and H. Savage. October 28th.

22,011. "Improvements relating to brushes or collectors for dynamos and motors." J. Dickson. October 28th.

PUBLISHED SPECIFICATIONS.

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1904

Electric Arc Lamps. Davy. 6,556. March 17th.

Electric Arc Lamps. Oliver. 15,453. July 11th.

Electric Cranes or the like. Imray. (Siemens Schuckert-Werke G.m.b.H.) 19,475. September 9th.

Electric Train Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 19,573. September 10th.

Electric Railways and Tramways. Clark. 19,651. September 12th.

Apparatus for Use in the Distribution of Alternating Electric Current. Berry. 19,749. September 13th.

Means by which the Points of an Electric Railway or Car Line may be Operated from an Approaching Car. Miller. 19,838. September 15th.

Fireproofing Electric Cables. Martin. 20,285. September 20th.

Overhead Conductor System for Electric Traction. Brooks and Watson. 20,585. September 24th.

Device for Piqueting Horses, Mules, Cattle, and for Guide Ropes for Tents and Telegraph Poles and the like. Connor. 22,107. October 14th.

Arc Lamp Hoisting Gear and Fittings for Same. Crompton & Co., Ltd., and Abbott. 22,362. October 17th.

Electrical Switches. Crompton & Co., Ltd., and Abbott. 22,364. October 17th.

Hangers or Ears for Electric Trolley Wires. Allen and Sharples. 23,032. October 26th.

Electric Projecting Lamps Chiefly for Enlarging and Projecting Lanterns. Kamm. 23,685. November 2nd.

Electric Cable Junction and Fuse Boxes. Le Feuyre and Greene. 24,138. November 8th.

Thermo-Electric Batteries. Johnson. (A. Wolff, Jun., & Co.) 24,177. November 8th.

Protective Devices for Electric Transmission Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 24,180. November 8th.

Field Magnets or Like Parts of Dynamos and other Rotary Electric Machines. Walker. 24,351. November 10th.

Combined Mouth Gag and Electric Light. MacCormac and Dental Manufacturing Co., Ltd. 24,384. November 10th.

Field Windings of Series-Wound Dynamo-Electric Machinery. Hills, Urquhart and Honey. 24,464. November 11th.

Electric Arc Lamps. Lewis, Case and Reason Manufacturing Co., Ltd. 24,477. November 11th.

Electrically-Operated Switches. Eckstein and Parker. 24,632. November 14th.

Electric Switches. British Thomson-Houston Co., Ltd. (General Electric Co.) 24,698. November 14th.

Manufacture of Storage Battery or Accumulator Electrodes. Boult. (Accumulatoren und Electricitäts-Werke Act.-Ges. vorm W. A. Boese & Co.) 25,265. November 21st.

Space Telegraphy. Stone. (Date applied for under International Convention, November 24th, 1903.) 25,638. November 24th.

Space Telegraphy. Stone. (Date applied for under International Convention, November 25th, 1903.) 25,644. November 24th.

Electric Secondary Batteries. Ekstromer Accumulator Co., Ltd., and Oppermann. 25,902. November 28th.

Means for Automatically Winding Clocks and the like with the Aid of Electricity. Hartmann. 25,985. November 24th.

1905.

Windings for Alternating Current Dynamo-Electric Machines. British Thomson-Houston Co., Ltd. (General Electric Co.) 22,821. October 22nd.

Construction of Trolley Head for Collecting Electricity from Electric Trolley Wires or the like. Phillips. 23,254. October 28th.

Electrical Radiators. Dowsing. 23,525. November 1st.

Driving Belts and the like for Preventing Electrification of the Same. Leloup, Obernesser, Tenthorey and Tenthorey. 23,573. November 1st.

Electric Motor Control Systems. British Thomson-Houston Co., Ltd. (General Electric Co.) 23,817. November 3rd.

Manufacture of Thermo Electric Batteries. Johnson. (A. Wolf, Junior, and Co.) 24,178. November 8th.

Systems of Electric Distribution. British Thomson-Houston Co., Ltd. (General Electric Co.) 24,181. November 8th.

Space Telegraphy. Stone. (Date applied for under International Convention, November 25th, 1903.) 25,642. November 24th.

Insulation of Wires Conducting Electricity. Longford. 167. January 4th.

Method of, and means for, Electrically Lighting Up Street and Other Gas Lamps whose Burners are Beyond Reach of Hand. Pare. 281. January 9th.

Field Windings for Single-Phase Alternating Current Electric Motors. Zani. 514. January 10th.